ENGINEERING AND MINING JOURNAL

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AUGUST 1955

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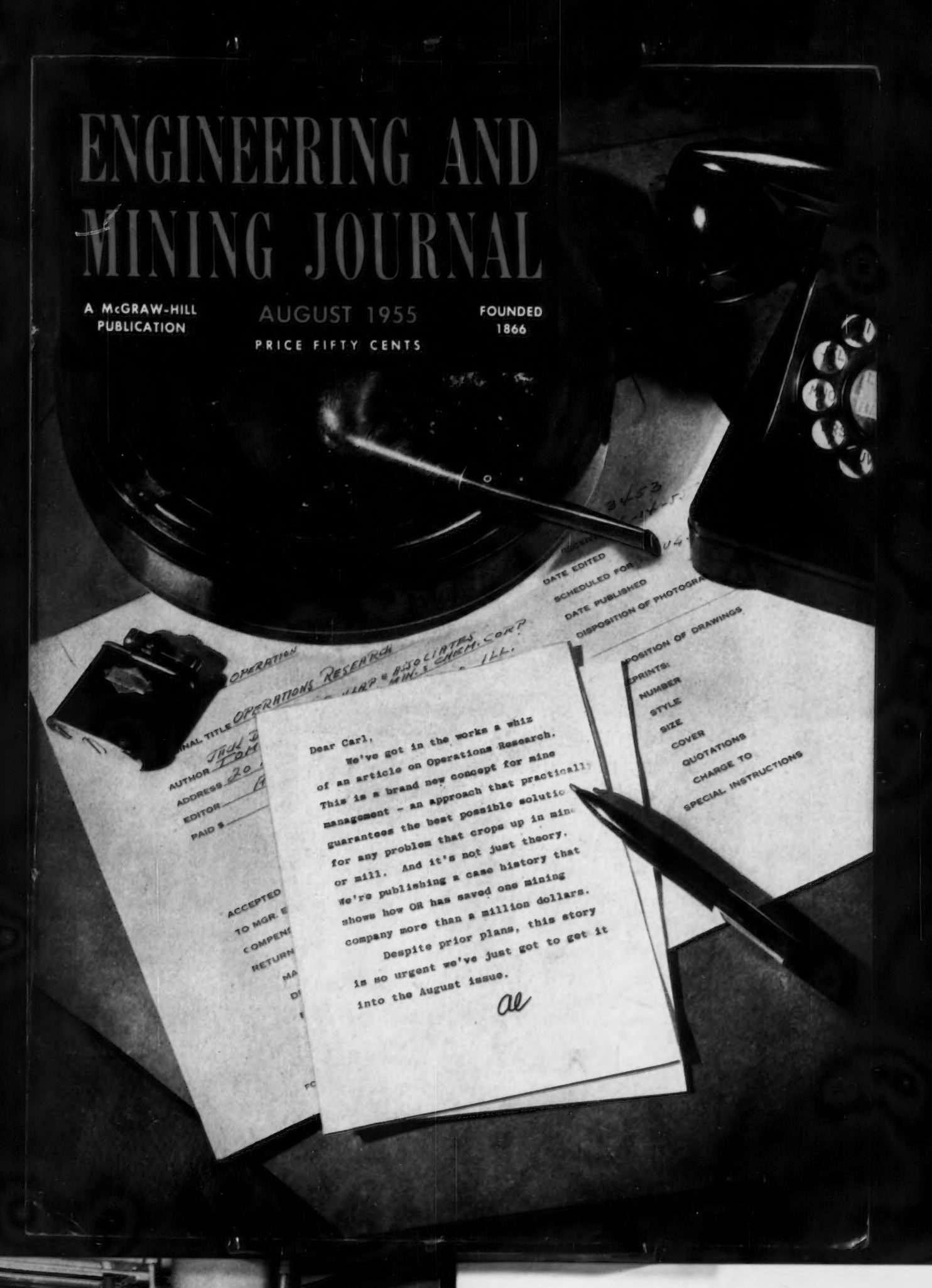
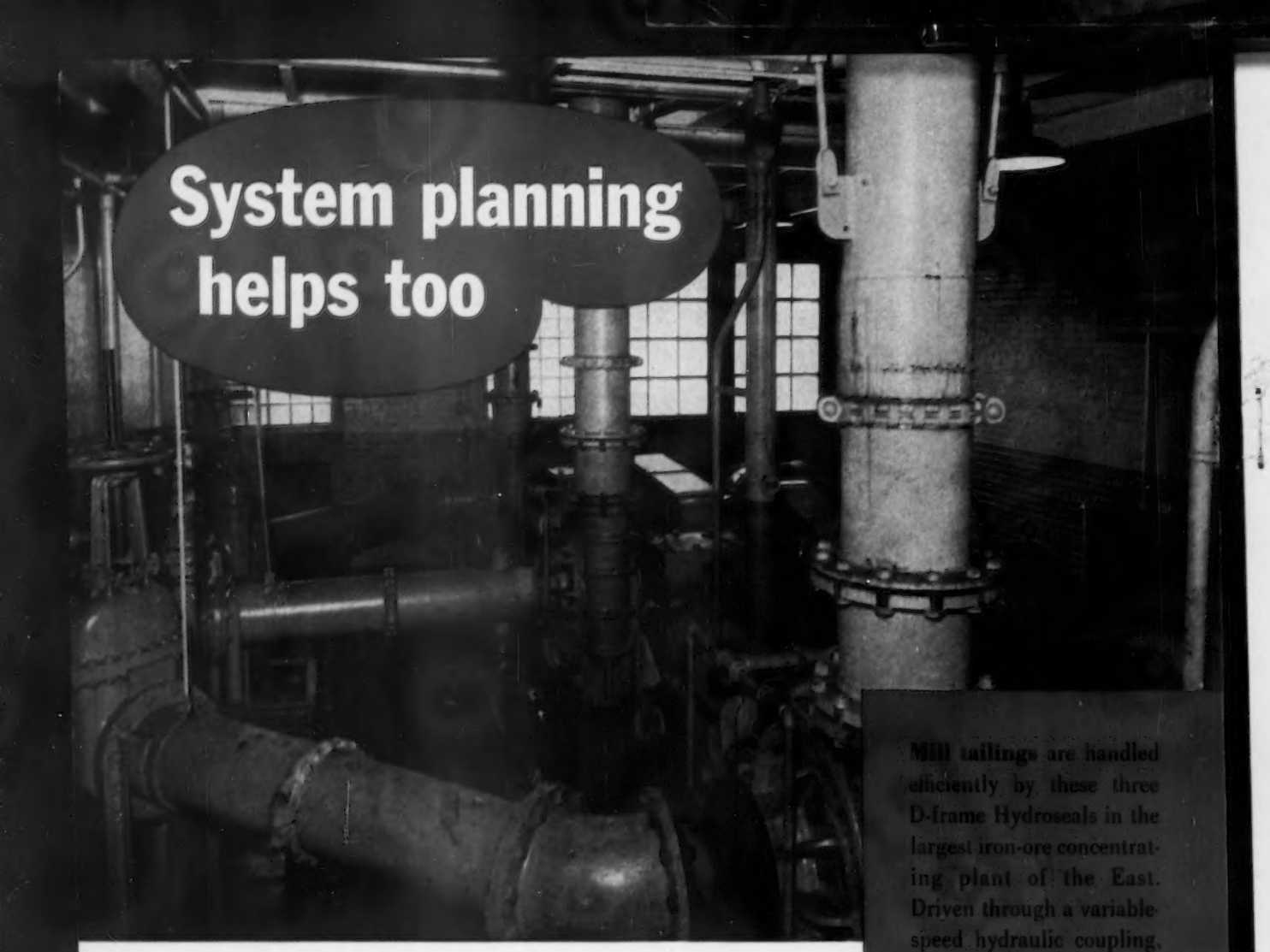




System planning helps too

Mill tailings are handled efficiently by these three D-frame Hydroseals in the largest iron-ore concentrating plant of the East. Driven through a variable-speed hydraulic coupling, one pump automatically compensates for changes of volume in the sump and/or changes in head. A second pump operates at constant speed, and the third pump is a standby.

Note the easy access to any part of each unit in this pump room. The arrangement is typical of what careful planning has done for this Eastern Pennsylvania iron-ore concentrating plant of an important steel producer. After years of depending on Hydroseal pumps, the now expanded system includes over 60 Hydroseals and Centriseals, the latter being used where pulp must be delivered undiluted. Efficient pumping, with savings in maintenance and power costs, is available to you too.

Refer your abrasives-pumping problem to us.

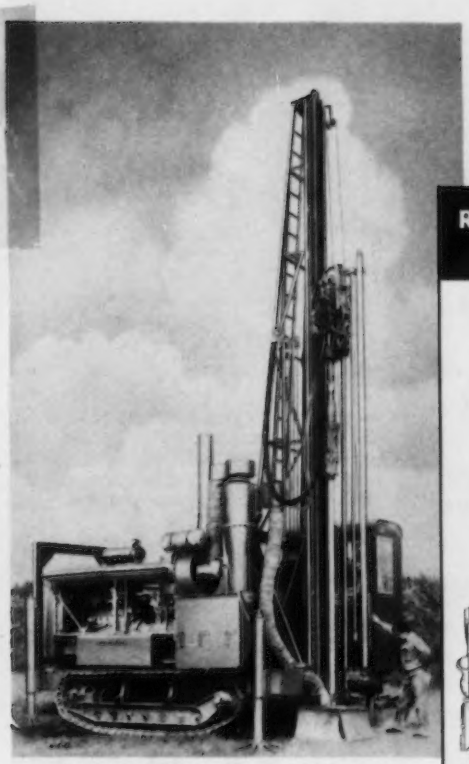
THE ALLEN-SHERMAN-HOFF PUMP CO.
Dept. B—259 E. Lancaster Ave., Wynnewood, Pa.
Representatives throughout the World

HYDROSEAL *and* **CENTRISEAL**
SAND, SLURRY & DREDGE PUMPS
MAXIMIX RUBBER PROTECTED

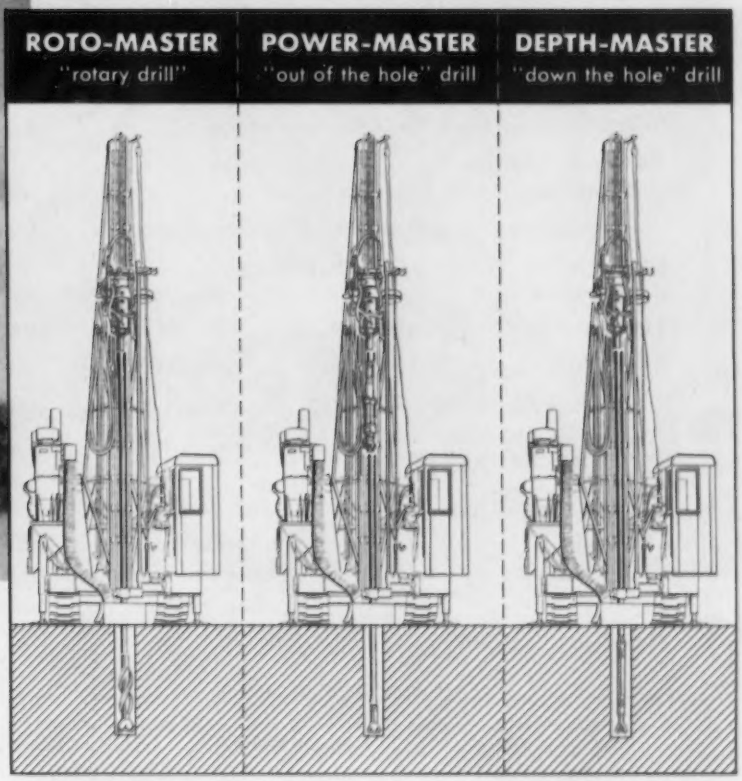
new three-way DRILLMASTER

. . . the only self-contained, self-powered drilling rig that combines these

3 advanced drilling methods:



Ingersoll-Rand Drillmaster equipped with the Power-Master "out of the hole" drill. Independent rotation is provided by the Roto-Master rotary drill.



Here's a totally new *three-way* rock drilling machine that provides a range of hole sizes and drilling depths heretofore not available.

The ROTO-MASTER rotary drill is ideal for roller cone bit drilling of holes up to 6¼" in diam. in relatively soft ground.

The POWER-MASTER combination provides maximum efficiency for hard rock percussion drilling of holes up to 4¼" in diam. and up to 60 ft. in depth.

And the DEPTH-MASTER "down the hole" drill provides maximum drilling speed for percussion drilling of 6" diam. holes to any practical depth in quarrying and construction work. This unique drill actually goes down the hole with the bit, eliminating the waste of power normally required to overcome the inertia of long lengths of drill steel.

For the complete story on this revolutionary new three-way Drillmaster, send today for your copy of Bulletin No. 4164.

Ingersoll-Rand
11 BROADWAY, NEW YORK 4, N. Y.

CARSET JACKBIT

5-223

ROCK DRILLS • COMPRESSORS • AIR TOOLS • TURBO BLOWERS • CONDENSERS • PUMPS • OIL & GAS ENGINES

ENGINEERING AND MINING JOURNAL

89th YEAR OF PUBLICATION

VOL. 156 No. 8

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LETTERS

Here's Julio

Dear Sirs:

This is to kindly request, if possible, your sending me the August 1952 issue. I would like to add, I am the man who appears in the cover. Thanking you in advance for your attention, and looking forward to hearing from you shortly, I am yours very truly.

Julio Davila Ruiz
Caparra Terrace
Puerto Rico

"Uranium Milling" Marches On

Dear Editor:

Referring to the uranium milling policy discussed in the June issue, Mr. Palmer asked the question: "Are advances being made in the field which would be of tremendous value to the miners?" Apparently, Mr. Johnson answered this question indirectly in his article. According to his discussion of the growth of the uranium operations, most of the production came from small deposits up to 1950. Since then the relative importance of such production has been greatly reduced, and the major part of the ore being mined now is from deposits of 50,000 tons or more, which contain 80% of the ore reserves.

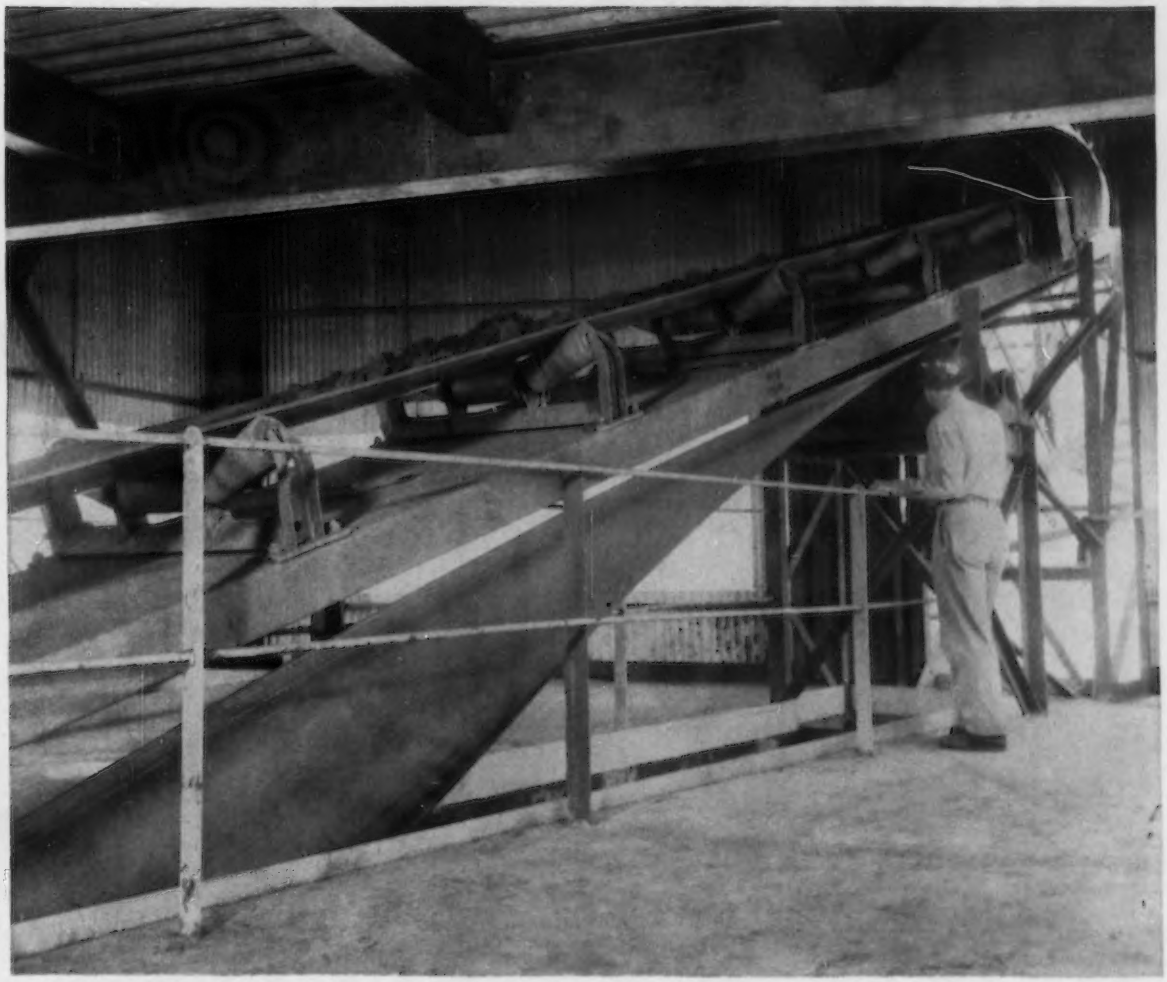
Mr. Palmer also asked: ". . . is there any thinking in high circles that a change in policy with reference to the buying of ore and the placing of restrictions on the sale thereof would tend to discourage the small and medium sized operator and force additional consolidations which are now taking place under present conditions?"

Referring to "the placing of restrictions" on the buying of ore, such as limiting ore purchases to the 1,000-ton non-contract commitment as suggested by Mr. Wilson in the May issue to force additional consolidations, it is clear from Mr. Johnson's statement, "This would be evasion, under a technicality, of the Commission's assurances to the miners", that no such policy is under consideration.

Regarding "a change in policy with reference to buying ore", it appears likely

(*Continued on p 112*)

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER



How conveyors stay clean even when load is sticky

THAT stuff riding the conveyor belt is refuse from a coal washing plant on its way to a dumping point—550 feet uphill. When plans were drawn up, engineers said the usual conveyor system wouldn't be the answer here. They knew the wet clay and sticky sand would cling to the belt, build up into gummy layers, clog the return idlers and pulleys, and damage the belt cover.

To avoid this trouble, they installed something quite different in conveyors—the B. F. Goodrich "Turnover" belt system. Here's how it works. As the material is dumped off the end of the moving belt, the belt makes a 180° turn, runs empty along the return idlers, then makes another one-half turn (as shown above) before receiving the next load.

Only the clean side of the belt touches the idlers, so there's no chance for sticky materials to build up on them. Even wet materials can be handled in cold weather without danger of the belt freezing to the rotating metal parts.

With the "Turnover" belt, expensive decking can be eliminated. Clean up of spillage is no problem because any material that falls on the lower run of the belt is carried to the end and dumped off when the belt makes its turn. Damage to belt body is reduced because lumps of materials cannot be trapped between the belt and pulleys.

If you have an operation where sticky, freezing or corrosive materials must be moved from place to place, the B. F. Goodrich "Turnover" conveyor system can save you trouble and money. Your B. F. Goodrich distributor can give you full details and show you how easy it is to convert any conventional system into the turnover type. *The B. F. Goodrich Company, Dept. M-463, Akron 18, Ohio.*

B.F.Goodrich
INDUSTRIAL PRODUCTS DIVISION

START WITH OLYMPIAN - FINISH WITH SAVINGS

YOU GET a head start in the race for lower costs when you lubricate mine car wheels with *Texaco Olympian Grease.* It assures easier start-ups, even in coldest weather. This means locomotives can haul longer trains, more tonnage . . . while maintenance costs go down.

Texaco Olympian Grease has outstanding resistance to oxidation and does not separate. It forms

TUNE IN . . . TEXACO STAR THEATER starring JIMMY DURANTE or DONALD O'CONNOR on television . . . Saturday nights, NBC.

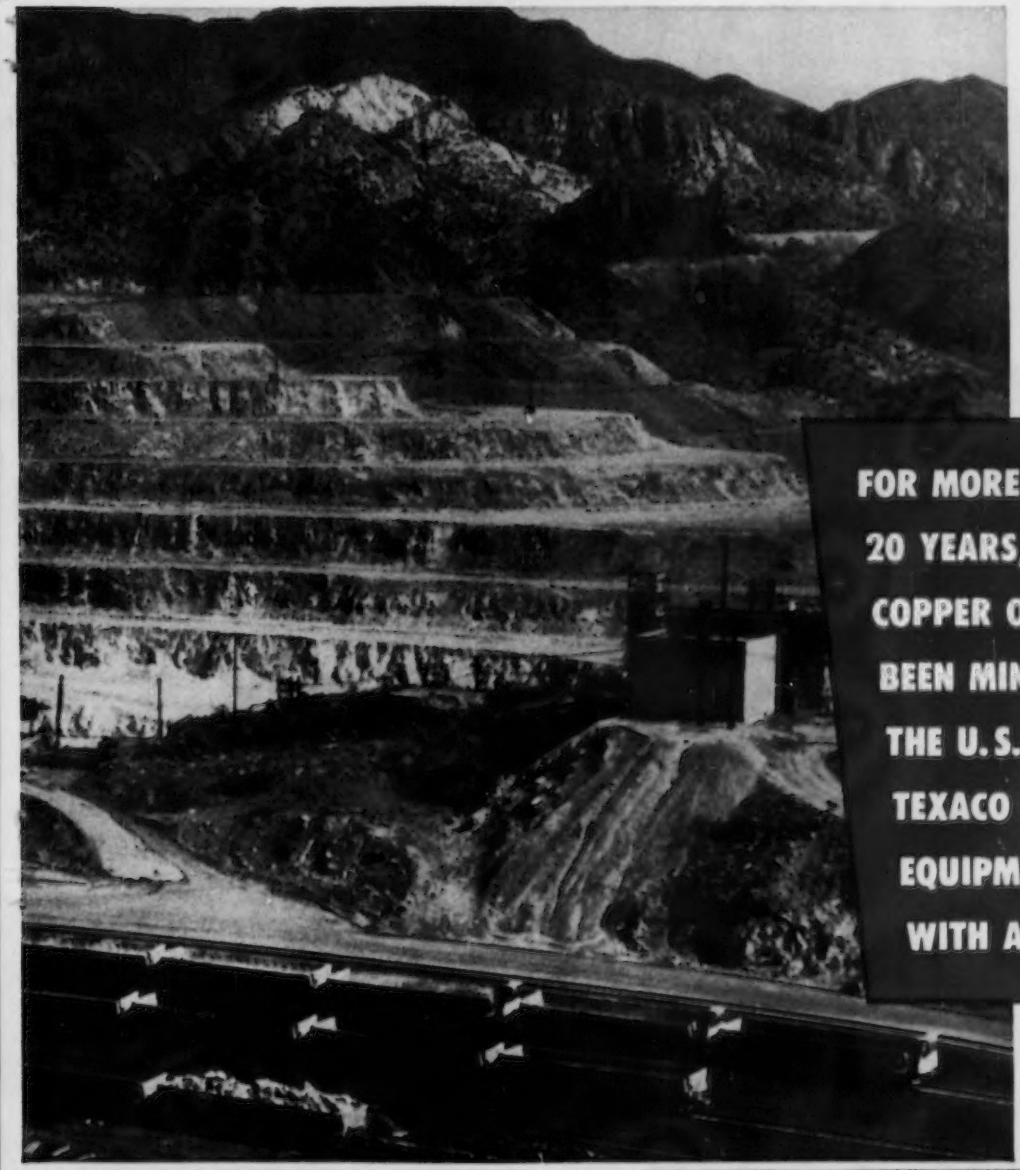
TEXACO

TEXACO

an effective barrier against dirt and moisture, prolongs bearing life by reducing wear. There are three consistencies of *Texaco Olympian Grease* to meet the needs of all plain, cavity hub or anti-friction bearings.

On wire rope and open gears, use *Texaco Crater X* or *Texaco Crater X Fluid*. Rope strength is preserved because both strands and core get full protection. Gears run quietly and smoothly under the heaviest loads.

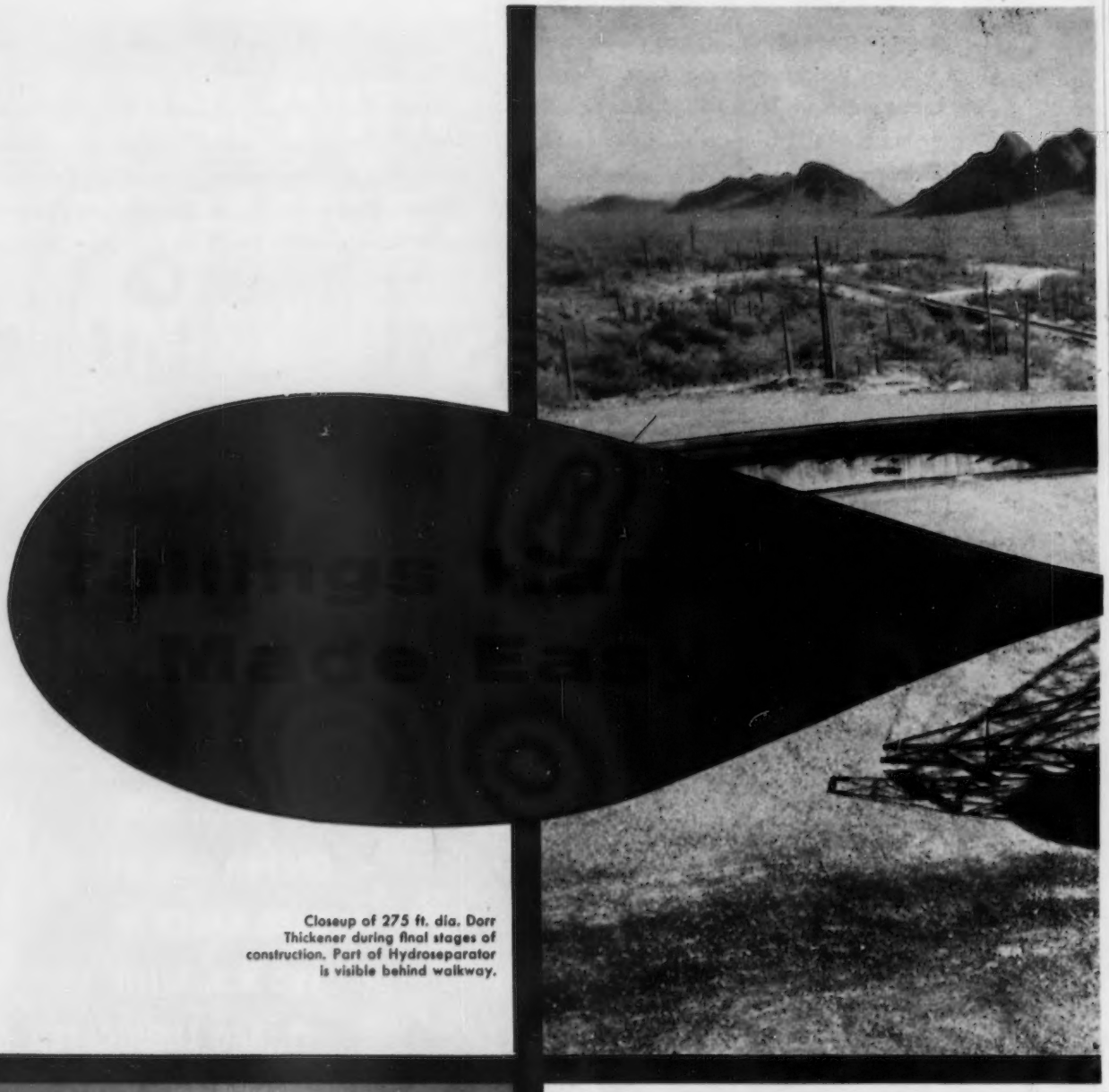
Texaco Lubrication Engineers have the know-how to help you get more efficiency and economy throughout your operation. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.



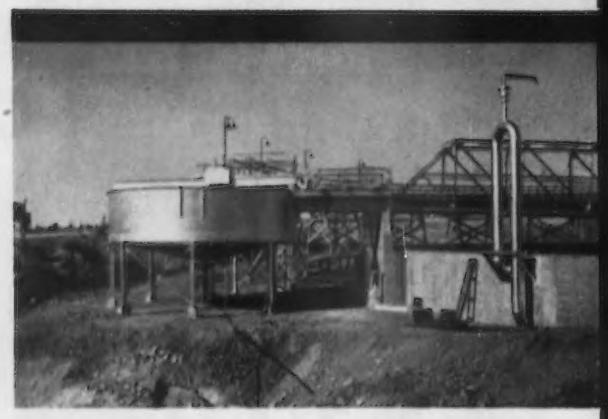
FOR MORE THAN 20 YEARS, MORE COPPER ORE HAS BEEN MINED IN THE U.S. WITH TEXACO LUBRICATED EQUIPMENT THAN WITH ANY OTHER

Lubricants and Fuels

FOR THE MINING INDUSTRY



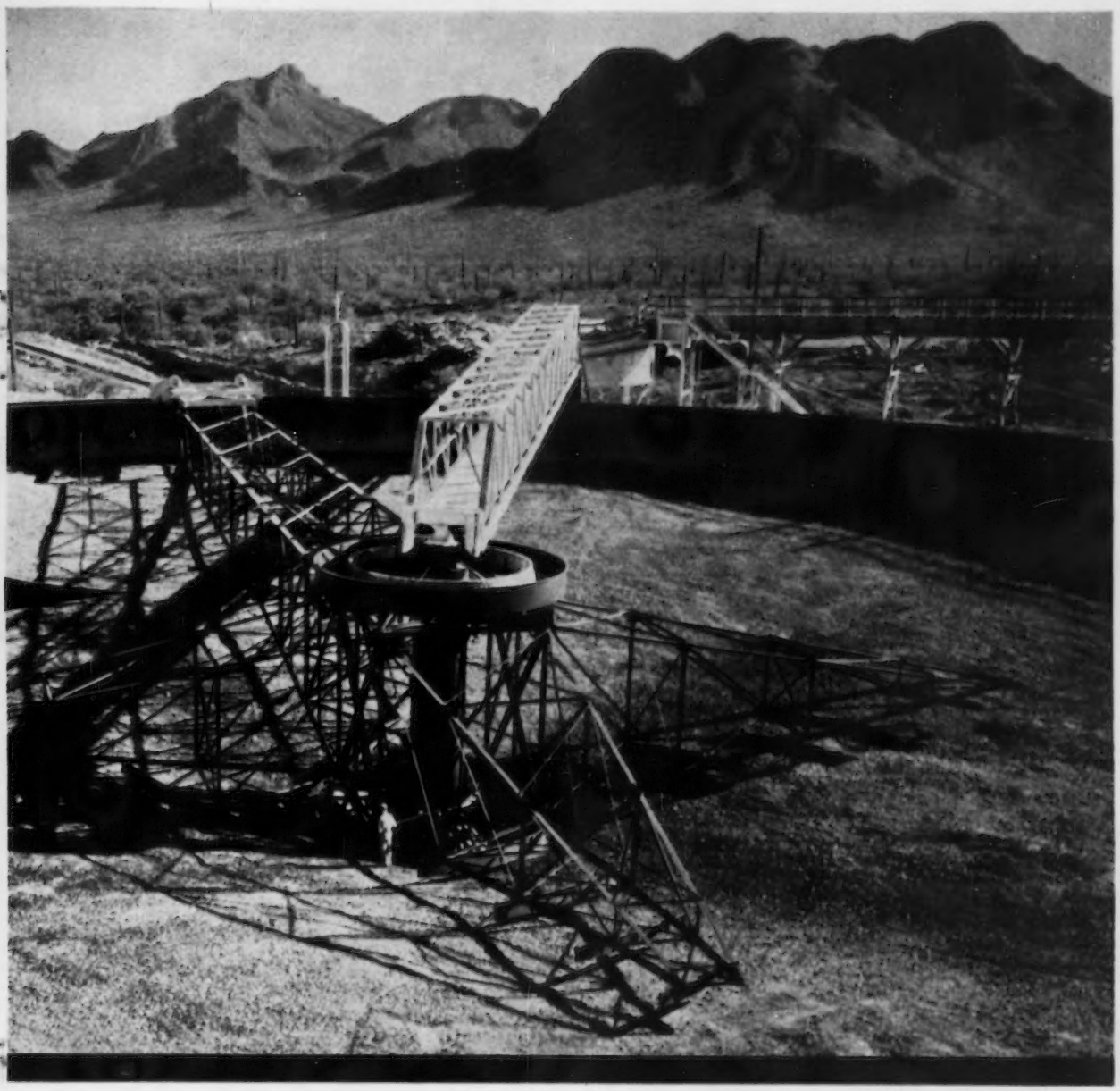
Closeup of 275 ft. dia. Dorr Thickener during final stages of construction. Part of Hydroseparator is visible behind walkway.



Hydroseparator at left with part of Thickener at right.

7450 TPD of copper tailings can be a big headache without proper disposal facilities. At a new Concentrator in Arizona the proven Dorr Hydroseparator-Thickener team is taking shock loads and variable feed characteristics in stride.

The giant Thickener — 275 ft. in diameter — dominates the picture. But equally important to successful operation is the 30 ft. diameter Dorr Hydroseparator.



By scalping out oversize material ahead of the Thickener, the Hydroseparator boosts thickening capacity and cuts water losses in the underflow.

We'd like to tell you more about Dorr-Oliver's ability to provide the correct solution to tailings handling problems. Just drop a note to Dorr-Oliver Incorporated, Stamford, Conn. or in Canada, 26 St. Clair Ave. East, Toronto 5.

DORR-OLIVER
INCORPORATED
WORLD-WIDE RESEARCH • ENGINEERING • EQUIPMENT
STAMFORD • CONNECTICUT • U.S.A.

Uranium Production Increased... Kerr-McGee Completes New Plant at Shiprock in Record Time

The Navajo Uranium Division of Kerr-McGee Oil Industries Inc., Shiprock, New Mexico, began operation November 1, 1954, at a tonnage greatly exceeding its planned capacity.

WKE Division of Western Machinery Company was given the go ahead on initial construction of buildings and facilities just nine months before final completion.

NEW Flowsheet. The carefully developed flowsheet, incorporating the new acid cure method of uranium concentration, was given constant and continuing study by Kerr-McGee metallurgists, the AEC, Navajo Uranium plant personnel and by WKE engineers. The result was optimum utilization of equipment and facilities for maximum recovery from the wide variety of ores submitted for treatment.

Progressive Engineering Pays Off. The new process necessitated progressive engineering and many problems impossible to foresee were worked out during design and construction, thus producing a better mill in record time.

The new $3,000,000 Kerr-McGee plant constructed by Western Knapp Engineering incorporates the latest methods for extraction of uranium concentrates. Every modern metallurgical facility has been engineered into this model custom mill.

W.K.E.

WESTERN KNAPP ENGINEERING CO.

DIVISION OF WESTERN MACHINERY COMPANY
760 Folsom Street • San Francisco 7 • California

For Complete Information, write for Bulletin G1-B4 Department A at the address shown above.

Record Tonnage Produced at Navajo Uranium Division

WEMCO Equipment Resists Highly Abrasive and Corrosive Treatment

New $3,000,000 Uranium producing mill of Kerr-McGee at Shiprock, N.M. built by WKE Division of Western Machinery Company.

Wemco Diaphragm Pumps handling thickener underflow are simple to adjust and service.

The new $3,000,000 plant built for Navajo Uranium Division of Kerr-McGee Oil Industries selected equipment on the basis of resistance to highly abrasive and corrosive conditions.

This new uranium plant at Shiprock, New Mexico, utilizes an acid cure flowsheet new to uranium processing. While much of the process is highly secret, it is well known that the corrosive acid content is high and damaging to equipment. Also, the fast settling coarse sands create an abrasive action which constantly exposes new surfaces to the adverse effects of corrosion.

Wemco Equipment in Flowsheet

Following grinding and screening, the liberated uranium ore is processed for repulping through WEMCO rubber covered agitators producing a pulp approximately 50% solids.

From the WEMCO Agitators the pulp flows through four WEMCO Spiral Classifiers in the modified CCD system for sand-slime separation. Exposed rotating parts of the classifiers are stainless steel with the spiral flights and tanks rubber covered to resist acid and abrasion. Acid proofing of the classifiers, including the submerged bearings and spirals, has been 100% effective. Flights can be added changing the classifiers from single to double or triple pitch if additional capacity is desired.

Underflow from the thickeners is handled in special acid resistant WEMCO Diaphragm Pumps. These pumps are designed for ease of maintenance and handling, with replacement of wearing parts reduced both in time and in frequency.

Precipitation of the final product utilizes specially developed WEMCO Agitators in part of the flocculating process.

Acid-abrasion resisting Wemco Spiral Classifiers eliminate approximately 60% of barren sands in the modified CCD system of Navajo Uranium.

Repulping, conditioning and part of the precipitation is handled in special Wemco Agitators.

WEMCO®
WESTERN MACHINERY COMPANY

760 Folsom Street • San Francisco 7 • California

Representatives in principal U.S. cities, in Canada and worldwide

For Complete Information, write for Bulletin G1-B4 Department A at the address shown above.

THIS AMSCO® LIP TAKES A SHARPER BITE

. . . chews out full loads at normal power

The lip juts way out where it easily bites up—and delivers—the full yardage of rock or earth. It's a sharp *extension* of the dipper, with fanned teeth—for fast, easy penetration. The dipper digs out a heavier load without strain on the shovel . . . even requires less power, and prolongs life of all parts.

This Amsco lip lasts a long, long time, because it's made of the toughest steel known—manganese steel—the metal that work-hardens to fight off wear by impact and abrasion. Lip replacement is simple, when necessary, keeping downtime short.

If getting more pay loads moved faster with less wear on equipment means more profits to you, *specify Amsco Renewable Lip Dippers.*

AMERICAN Brake Shoe COMPANY

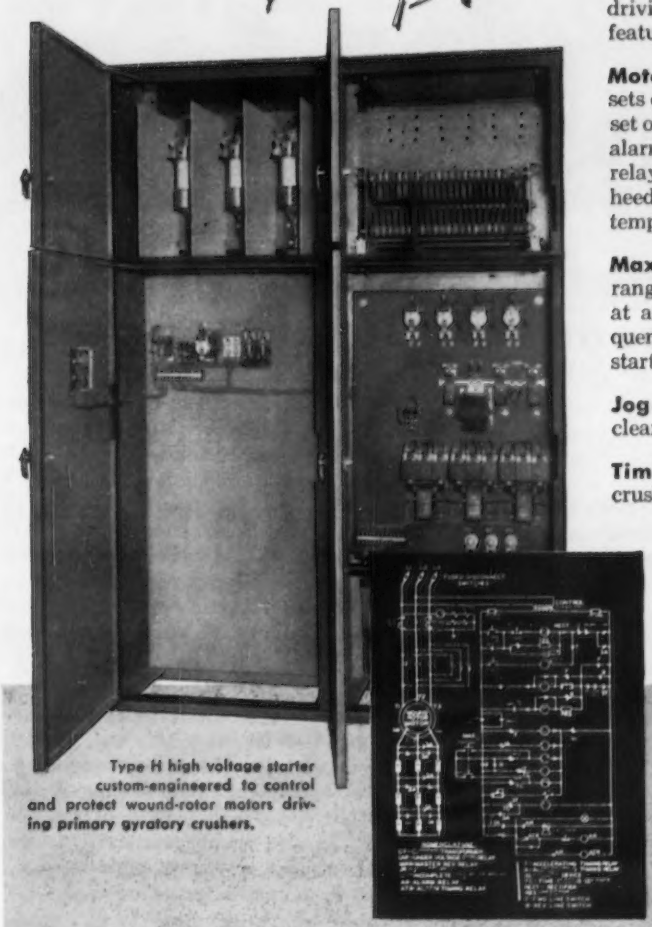
AMERICAN MANGANESE STEEL DIVISION
Chicago Heights, Ill.

CUT CRUSHER DOWN-TIME

with Custom-Engineered

ALLIS-CHALMERS

CONTROL



Type H high voltage starter custom-engineered to control and protect wound-rotor motors driving primary gyratory crushers.

Allis-Chalmers has built and installed hundreds of gyratory crushers in the past 75 years. Drawing on this experience, A-C engineers have developed a control circuit designed to cut costly down-time in the rough-tough job of rock and ore crushing. This control circuit is considered by rock products operators to be the ultimate in control and protection for wound-rotor motors driving primary gyratory crushers. Here are some features of this circuit:

Motor Overload Protection — Two separate sets of thermal overload relays are provided. One set operates on slightest overload to sound remote alarm horn and energize indicating light. These relays do not stop motor. If warnings are not heeded, a second set of relays stops motor when temperature reaches danger point.

Maximum Torque Starting — Control is arranged so that maximum torque can be obtained at any time while motor is being started. Frequently, application of maximum torque permits starting a stalled crusher and clearing jam.

Jog-Reversing Controller permits rocking to clear jam.

Time-Delay Undervoltage Relay allows crusher to ride through momentary voltage dips.

Stall Protection — On currents greater than normal load peaks, the motor is disconnected through an instantaneous current relay.

Write for details. Explanatory material is yours for the asking. See your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4525

ALLIS-CHALMERS

3 Types of Headed Bolts for Dependable Roof Support

To assist you in advancing safety standards, three types of Bethlehem square-head bolts are now available for roof support. These Bethlehem roof bolts not only minimize roof-fall accidents by anchoring overlying rock, but also offer other worthwhile advantages when used instead of old-fashioned, bulky supports.

Roof bolts take less time to install. They require less storage space, both above and below ground. And they improve ventilation, and make it possible for mechanized equipment to be used close to the face.

Bethlehem's square-head bolts are: (1) a ¾-in. carbon-steel bolt, having a typical breaking load of 24,000 lb, (2) a ⅞-in. high-strength bolt, also having a typical breaking load of 24,000 lb, and (3) a ⅞-in. high-strength bolt, having a typical breaking load of 45,000 lb.

The ¾-in. and ⅞-in. square-head bolts can be used with either Bethlehem's matching-halves Type F expansion shell, or the 4-leaf Type C expansion shell, in a 1⅜-in. hole. The ⅞-in. bolt is intended for use with the Type F shell only, in a 1½-in. hole.

If you would like to know which type of roof bolt can be used to best advantage in your mines, we suggest that you get in touch with the nearest Bethlehem sales office and arrange for one of our roof-bolting specialists to call on you.

HARDENED WASHERS, TOO

Bethlehem makes hardened washers in various sizes, for use with all three types of headed roof bolts. The washers reduce friction between the bolt head and the roof plate, occurring when high tension in the bolt causes excessive bearing pressure. They also prevent galling or tearing of metal when pneumatic impact wrenches are used.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM MINE ROOF BOLTS

BETHLEHEM STEEL

LESS WASTED DRILLING TIME!

TIMKEN® interchangeable rock bits let you switch bit types without switching drill steels

Dozens of different TIMKEN® multi-use and carbide insert bits fit the same steel

YOUR drillers can change Timken® interchangeable rock bits quickly, easily, right on the job. They won't waste valuable drilling time going after a different set of drill steels every time a different bit type is needed. They'll simply unscrew one type of Timken bit and screw another right on the same steel. ..nd they can make this change in one minute flat!

You get extra drilling economy because your drillers can always switch to the most economical bit as the ground changes—right on the job. And because dozens of different Timken multi-use and carbide insert bits fit the same steel, you don't have to carry an expensive inventory of drill steels.

Both Timken carbide insert and multi-use bits are made from electric furnace Timken fine alloy steel. Both have special shoulder unions that keep drilling impact from damaging threads.

Our rock bit engineers are experts at cutting drilling costs. Maybe they can save you some money? Drop them a line. There's no obligation. Write: The Timken Roller Bearing Company, Rock Bit Division, Canton 6, Ohio. Cable address: "TIMROSCO".

WHERE YOU CUT COSTS WITH TIMKEN MULTI-USE BITS

Most economical for ordinary ground. With correct and controlled reconditioning, they give lowest cost per foot of hole when full increments of steel can be drilled.

WHERE YOU CUT COSTS WITH TIMKEN CARBIDE INSERT BITS

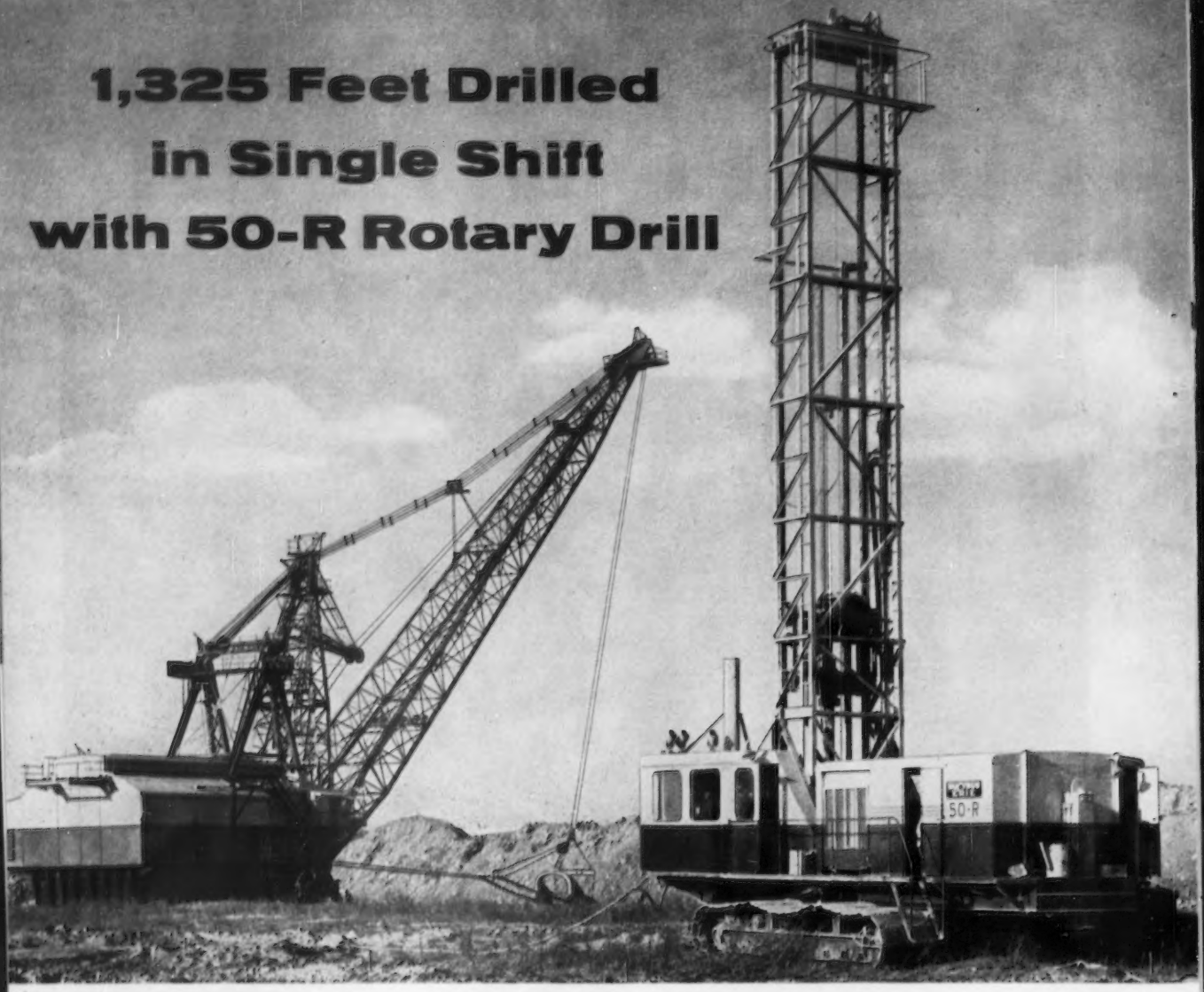
Give highest speed through hard, abrasive ground. Also most economical for constant-gage holes, small diameter holes, very deep holes.

... your best bet for the best bit... for every job

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

1,325 Feet Drilled in Single Shift with 50-R Rotary Drill



A total of 1,325 feet drilled in a single shift of 6¼ hours — that's the remarkable performance record set by a 50-R drill last January. Owned by the Maumee Collieries Company, this machine was drilling in overburden consisting of medium hard sandstone with an overlay of hard shale. Holes averaged 40 feet in depth — the average footage drilled per hour was 196 feet. In this single shift, the 50-R completed 33 holes!

This is just one of many case histories which are proving the drilling superiority of the 50-R daily. Behind performance like this are these outstanding features:

- *Ward Leonard electric control on rotation of drill pipe permits drilling at most efficient speed for a given formation.*
- *Pulldown force is hydraulically powered for maximum controlled penetration.*
- *Machine drills continuously for 32½ feet before an additional drill pipe section must be added.*
- *Remote-controlled power-driven tool handling unit permits drill pipe sections to be added or removed in a few minutes and without heavy manual effort.*

For complete information on the 50-R, write directly to us. Also ask about the 40-R, a smaller Bucyrus-Erie rotary for drilling 6¾ to 9-in. holes. 19B55C

BUCYRUS ERIE

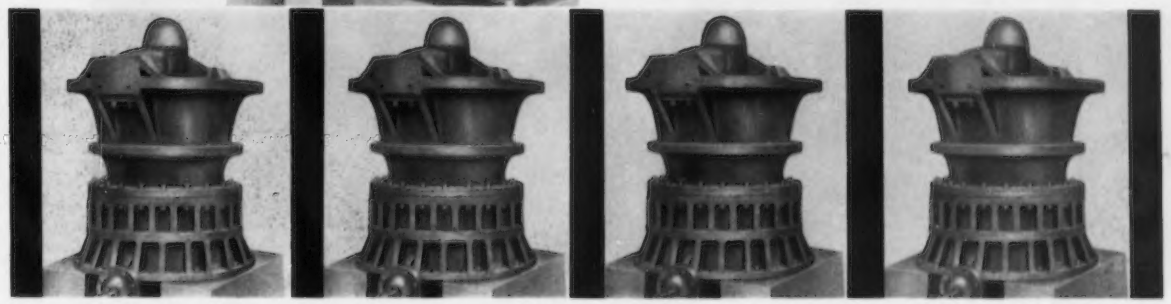
South Milwaukee
Wisconsin

1880 75 1955
YEARS OF SERVICE
to Men Who
Shape the Earth

Erie Mining uses Traylor's Experience to get Economical Production of Taconite Ore

Traylor Now Building Giant Primary Crusher

WITH 60" RECEIVING OPENING AND 120" DIAMETER CRUSHING HEAD



. . . plus four 36" Gyratories for Erie Mining Company's Aurora Project

Profitable production of iron ore from low-grade Taconite calls for the most modern, efficient methods and equipment. That's why Erie selected Traylor Gyratories for both primary and secondary reduction of the extremely hard Taconite-bearing rock.

Traylor is now building for Erie a huge 60" Gyratory Primary Crusher which is higher than a three-story house and weighs more than a million and a quarter pounds . . . this giant TC Gyratory is the seventh of its kind to be built by Traylor. Chunks of ore the size of a flat-top desk dumped into this crusher at the rate of 4,400 long tons per hour will be reduced to 12". In a 15 hour day, this TC will crush 66,000 long tons of rock. Four 36" Traylor Gyratories will take the 12" ore from the crusher and reduce it to minus 5" in the secondary reduction operation.

For the past 50 years, leaders in the mining industry throughout the world have turned to Traylor for the most efficient equipment to help them keep pace with advanced mining methods.

★ ★ ★

For complete specifications and description of the outstanding features of Traylor TC Gyratory Crushers, send for your copy of Traylor Bulletin No. 126.

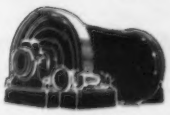
TRAYLOR ENGINEERING & MFG. CO.
1712 MILL ST., ALLENTOWN, PA.
SALES OFFICES: New York • Chicago • San Francisco
Canadian Mfrs: Canadian Vickers, Ltd., Montreal, P.Q.

A Traylor leads to greater profits

Primary Gyratory Crushers

Rotary Kilns

Secondary Gyratory Crushers


Ball Mills

Jaw Crushers

Apron Feeders

Sherritt Gordon and Gardner-Denver partners in pioneering

Congratulations Sherritt Gordon! We are proud that Gardner-Denver has played an important part in Sherritt Gordon mining operations at Lynn Lake, from development to production. Much of the initial shaft-sinking was done by Gardner-Denver S48T sinkers—all cross-cutting and drift work with Gardner-Denver Model J track mounted jumbos with SF73 drifters—sublevel drifts driven by Gardner-Denver air leg mounted S48's—and all blast hole drilling with SFH99 deep hole machines.

Gardner-Denver products used by Sherritt Gordon include:

GH9 and GD9H mine car loaders
Series J 3-boom jumbo
SF73 drifters
SFH99 drifters for all blast hole drilling
S48 sinkers with FL2AY-4 feed legs
R94 and R104 stopers
Model HK tugger hoists servicing sublevels

GARDNER-DENVER Since 1859

KELLER TOOLS

GARDNER-DENVER

THE QUALITY LEADER IN COMPRESSORS, PUMPS AND ROCK DRILLS FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

Gardner-Denver Company, Quincy, Illinois
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Intermittently all day long, Tournatractor dozes iron cinders to clamshell bucket on overhead crane. It also dozes in the limestone, shale, and gypsum...completes jobs in few minutes.

One of Tournatractor's service jobs is to grade and gravel mountain haul road. Half-mile uphill trip takes only about 5 minutes. Rubber tires do not tear up roadway, can go anywhere. Machine frequently enters plant for service jobs. Crawlers cannot.

"*Runs* wherever it is needed"

Rubber-tired tractor does a dozen jobs a day at Canadian cement plant

When one of Canada's largest cement manufacturers expanded one of their plants, their one crawler could no longer handle all the tractor jobs around the yard. Since some of these jobs were a half-mile apart, they either had to buy another crawler, or get a faster machine that could do the work of 2 crawlers.

Replaces crawler

A similar problem had arisen before, and they used the same solution they had found satisfactory at another of their plants. They bought a 19 mph rubber-tired Tournatractor.

"Tournatractor goes anywhere fast," explains the general mill foreman. "It will work here a while, and then go over there. It runs wherever it is needed!"

Spots 100-ton rail cars

One of the Tournatractor's most frequent jobs is spotting railroad cars, some empty, some loaded with 100 tons of cement. It can easily push a dozen empty cars, the mill foreman says. He doesn't know how many loaded cars it can handle, since it has never been necessary to move more than one at a time. "We have had cars off the track, though," he points out, "and Tournatractor pushes them back on without any trouble. One thing we especially like is the way it goes across tracks. A crawler will tear the blazes out of ties and rails, but those soft tires do not hurt them at all."

Maintains haul roads

Tournatractor's Angledozer blade is especially useful for grading the half-mile haul road from the pit. Trucks braking down the mountainside create a washboard effect in the road. Instead of riding up and down on these ridges as an ordinary dozer blade tends to do, Angledozer slices crosswise through them. Angle of cut, plus down-pressure, keeps blade from bouncing, quickly blades road smooth. Tournatractor then covers surface with gravel. Final step is to back-blade down the hill to smooth out the finished grade.

"On this work," mill foreman continues, "Tournatractor makes 3 or 4 trips up and down the road while a crawler would make only one."

Lowers repair costs

Despite its greater-than-crawler speeds, Tournatractor has needed practically no repairs. In the 90-day period before these pictures were taken, for instance, machine was stopped only 4 times — 3 times for cable changes (each requiring about an hour) and once to replace a small electrical part.

Another important advantage of Tournatractor that the foreman mentioned was that its tires gave a lot more mileage than did crawler tracks. "You put 35% of your wear on a crawler just in driving job-to-job," he says, "while traveling doesn't hurt Tournatractor tires at all."

Before *you* buy another set of tracks, it will pay you to investigate Tournatractor. Ask your LeTourneau-Westinghouse Distributor for the proof of an on-your-job demonstration.

Some of the jobs this one Tournatractor does

1. Stockpiles coal
2. Grades and gravels half-mile haul road
3. Dozes 100 tons of gypsum per day into hammermill
4. Spots railroad cars
5. Backfills quarried-out spots in the yard
6. Bulldozes the waste dump
7. Handles all clean-up for shovel in old pit
8. Cleans up for shovel in new pit when crawler is down for repairs or can't keep up with work
9. Moves machinery
10. Cleans up yard
11. Stockpiles iron cinders, limestone, and gypsum
12. Feeds iron cinders to clamshell in plant
13. Pushes derailed cars back on track
14. Plows snow from haul roads and plant area

Tournatractor makes fast work of tearing down a ramp. One of its most important jobs is to keep haul road and yard free of limestone chunks dropped by trucks. Rock, which frequently wedges in and damages dual truck tires, does not injure tractor's big single tires.

Stockpiling and feeding of gypsum to hammermill is another daily task for Tournatractor. These and the finer abrasives, like cinders, do far less harm to the rubber than they do to tracks, says the plant's master mechanic.

LeTourneau-Westinghouse Company

PEORIA ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

Tournatractor — Trademark — Angledozer Trademark Reg. U.S. Pat. Off. T-566-Q-b

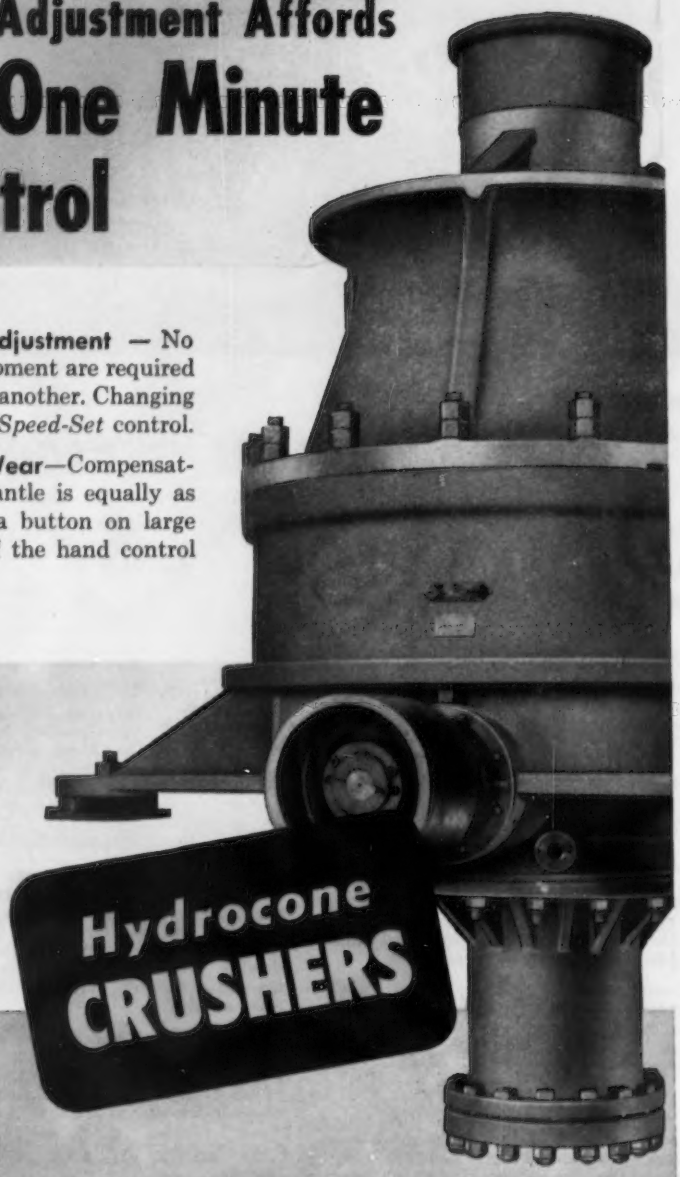
Speed-Set Hydraulic Adjustment Affords

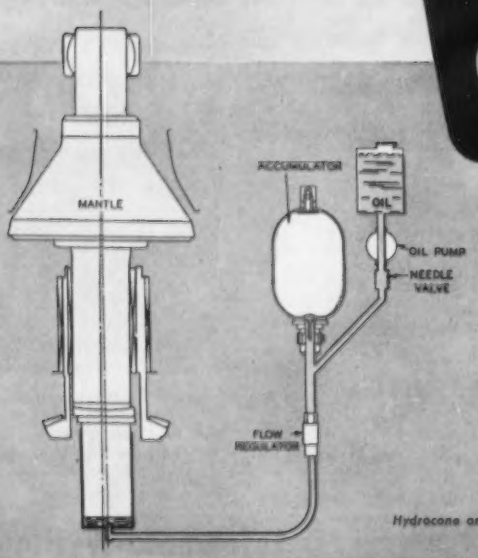
One Man...One Minute Product Control

Quick, Accurate Product Size Adjustment — No dismantling and no auxiliary equipment are required to change from one product size to another. Changing is instantaneous and precise with *Speed-Set* control.

Simplified Compensation for Wear—Compensating for wear on concaves and mantle is equally as fast and convenient. A push of a button on large *Hydrocone* crushers or a move of the hand control on smaller sizes does the job.

Fast Emergency Unloading and Tramp Iron Protection — If crusher stops abruptly because of power failure or other emergency, *Speed-Set* control facilitates fast clearing of crushing chamber.





How *Speed-Set* Control Works

Mainshaft assembly is supported on hydraulic jack. Oil pumped into or out of jack raises or lowers crushing mantle.

When tramp iron enters crushing chamber, oil from jack is forced into accumulator, allowing mantle to lower. Automatic reset returns cone to original setting after tramp material is passed.

For complete information, see your A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 07B7145B.

A-4478

Hydrocone and Speed-Set are Allis-Chalmers trademarks.

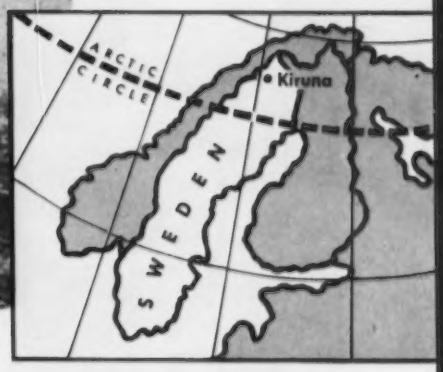
ALLIS-CHALMERS

A-C ALLIS-CHALMERS

blades road smooth. Tournatractor then

plant area

After 50 years of mining, not much is left of Kiirunavaara, the larger of the iron mountains. Its top ridge, originally 750 ft. high has been excavated until it has become a gorge 11,000 ft. long and 1,350 ft. wide. Terraces of waste rock cover the rest of Kiirunavaara.



Hauling 8,500,000 tons of iron ore yearly

Owner calls these Rear-Dumps "Most economical, most rugged machines we have ever used"

Near Kiruna, Sweden, 90 miles north of the Arctic Circle, stand two mountains of iron ore, "Kiirunavaara" and "Luossavaara". They represent two of the most valuable mineral deposits in the world, outstanding both for high iron content and for size.

At present, the two mountains yield 8,500,000 tons of iron ore every year. Thirty trainloads are shipped daily, most of them destined for export to U.S.A., England, and Germany. Within the next ten years, output will be increased to 12,000,000 tons of ore annually.

"D" Rear-Dumps haul from pit to crusher

To help reach this production goal, the contracting firm, Broderna Holm, of Ojebyn, Sweden, purchased 2 Model D Rear-Dump Tournapulls to haul from mine to crusher. Under present schedules, the ore is blasted twice a day. After the smoke and dust have cleared, material is shovel-loaded into the Tournapulls for a 1575-ft. uphill haul to the crusher. Despite grades to 10%, average cycle takes 9 minutes. Of this, 3 minutes is used for loading. Each Tournapull delivers 5 to 6 loads (55 to 66 tons) per 50-minute hour. This output has been maintained both in the summer, when haul roads are rocky and abrasive, and in winter when snow makes footing treacherous. Tournapulls easily overcome both difficulties; their big low-pressure tires provide good traction on the icy surfaces, plus cushioning for hauling over rock without damage.

"Not one day's downtime!"

Tournapull Rear-Dumps also eliminate entirely such trouble sources as body frames, sub-frames, springs and hydraulic systems. Yngve Holm, one of the owners of Broderna Holm says, "Tournapull Rear-Dumps are the most rugged and most economical machines we have ever used. We have had no downtime in over 1,400 hours of double-shift work in 5 months."

If your work involves hauling rock, or other shovel-loaded material, Tournapulls can mean greater output at lower cost to you, too. There is a Rear-Dump size to fit your needs — 9, 18, 35 and 50 tons. Purchases can be made for pounds sterling or U.S. dollars. Call or write for all the facts.

Mine output is limited by the crusher capacity. Tournapull Rear-Dumps must dump their loads into the hopper in two operations to avoid choking. The mine, Luossavaara Kiirunavaara Aktiebolag, is located 1,500 ft. above sea level, just below the timber line. Work is possible here in winter, because the Gulf Stream warms the winds blowing from north and west, while the mountains of Norway extract much moisture from the air.

Tournapull — Trademark Reg. U.S. Pat. Off. DR-527-M-b

LeTourneau-Westinghouse Company

PEORIA, ILLINOIS

A Subsidiary of Westinghouse Air Brake Company

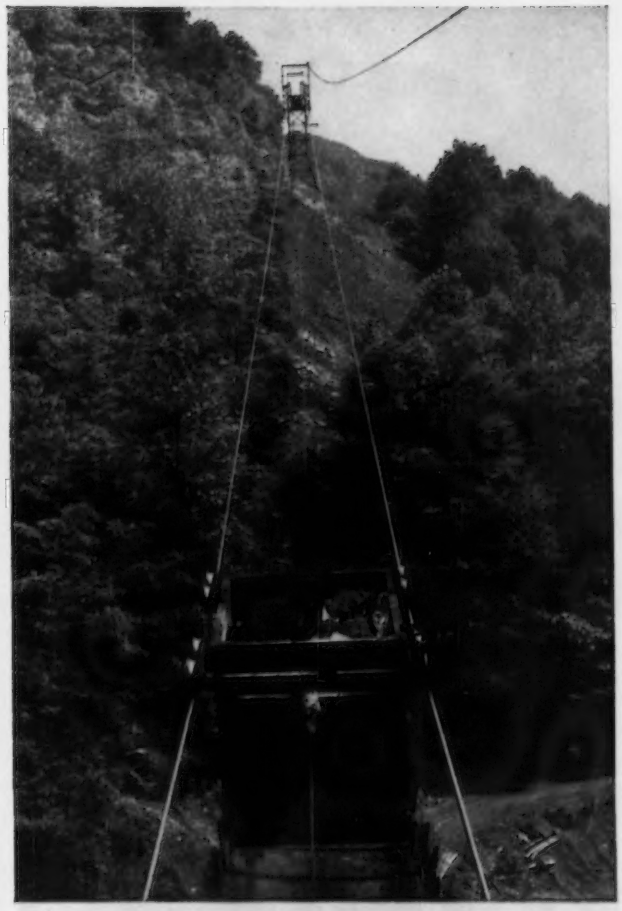
▲ **Tiger Brand Tramway** at mine No. 22 of the Island Creek Coal Company.

Clouds of abrasive dust make this service tough ▼ on wire rope but Tiger Brand is built to take the punishment.

The Right Wire Rope will do the trick!

(55 to 66 tons) per 50-minute hour.

tram hauls 2,000,000 tons of material —*and is still going strong!*



▲ **15 years of service** hauling mine refuse and these Tiger Brand Wire Ropes still have lots of life in them.

The Island Creek Coal Company in Holden, West Virginia needed a low-cost method of getting rid of mine refuse. So they built this tramway in 1939, using Tiger Brand Wire Rope.

In fifteen years, they hauled more than 2,000,000 tons of material and dumped it over the next hill out of the way. An examination of the track cables showed that they were still in good condition in spite of the fact that they get covered with abrasive rock dust.

Service like this is not unusual. We know of many Tiger Brand Ropes on heavy-duty mining and construction equipment that have moved a million or more yards before replacement.

On any job, the correct Tiger Brand Rope gives you the longest possible service . . . steady rope-after-rope performance that keeps costs down.

Send the coupon for more information on Tiger Brand Wire Ropes.

FREE ROPE BOOKLET

American Steel & Wire
Rockefeller Building, Dept. C-85
Cleveland 13, Ohio

Please send me, without obligation, a copy of your helpful wire rope selection guide, "The Right Rope for the Job."

Name .....

Company .....

Address .....

City & State .....

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

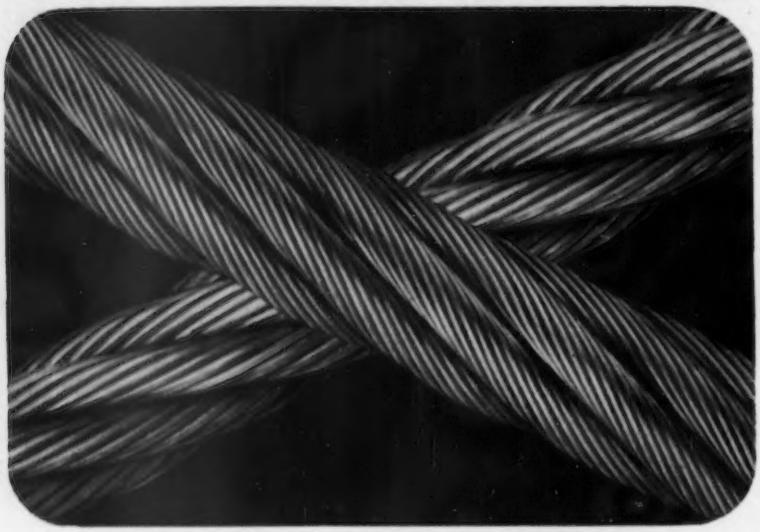
USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

USS

UNITED STATES STEEL

FIRST WE DEVELOPED 1105 ROPE WIRE.



THEN WE MADE ROEBLING'S

Royal Blue

WIRE 1105 ROPE

1105 takes Royal Blue out of the ordinary wire rope class.

1105 is a rope wire that's new—that's stronger. It's the biggest news in many years.

1105 is the result of more than a century of research and development—it's the wire that gives Roebling Royal Blue the stamina that pays off in service.

Contact your Roebling distributor or write us for the full story.

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 51 SLEEPER ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 230 VINE ST. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

DO YOU HANDLE WET, STICKY ORES THAT FOUL UP YOUR CONVEYOR IDLERS?

The Joy Limberoller idler installation shown above is in a magnesium foundry, supporting a 30″ belt which carries abrasive material up a 35° slope. *To date, these idlers have been on the job 10 times longer than conventional idlers previously lasted—and they're still going strong!*

ONLY 2 BEARINGS, UP OUT OF THE DIRT ...The Joy Limberoller idler consists of neoprene discs molded on neoprene-covered flexible steel cable. It is suspended from two bearings, one on each end, *out of the dirt zone.* This distinctive design, field-proved by thousands of idlers already in service, averts fouled idler rolls—protects the belt from damage—reduces your maintenance to a fraction.

OTHER ADVANTAGES, TOO . . . Joy idlers are self-training—they conform to the load with a cushioned grip which supports the loaded belt without slipping and reduces belt wear. They resist corrosion, abrasion, flame and grease—weigh ⅔ less than steel idlers, and handle bulk or packaged materials equally well. They're easily changed *without stopping the belt,* and compactly stored.

Whatever your belt conveyor job may be, let us help you to make it more efficient and economical. Joy Limberoller Idlers are available for belt widths of 18″, 24″, 30″ and 36″—and you'll find them easier, faster and less costly to install, maintain, knock down and move than any other conveyor idler on the market. ● ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

WRITE FOR COMPLETE DETAILS

Ask for free *Bulletin LD-103 F.* It gives complete information on the unique Limberoller Idler, and we'll be glad to supplement it with engineering assistance on your particular problem.

Consult a Joy Engineer

W&D M 5686C

JOY

SINCE 1851—OVER 100 YEARS OF ENGINEERING LEADERSHIP

Check

PRICE PER POUND OF LIFT CAPACITY

Here is a sound way to measure the value of excavators and cranes. Compare machines on the basis of price per pound of lifting capacity. You'll very quickly learn which machine offers you the biggest production capacity per dollar of equipment investment.

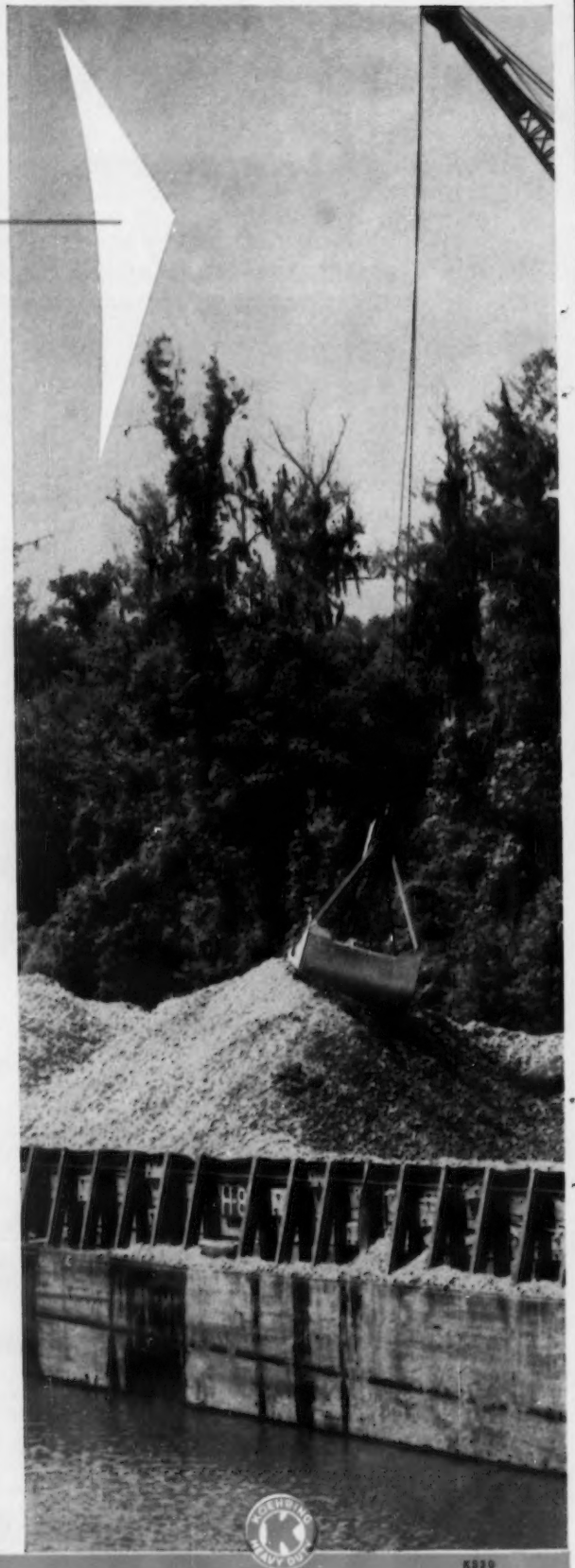
Remember — lift capacity is *work capacity*. Obviously, the machine with heaviest lift rating not only picks up larger crane loads. It also has more strength, speed and stability with every excavator attachment to handle bigger loads on a faster operating cycle.

Check the Koehring lift ratings shown below — then ask your Koehring distributor to give you the figures on price per pound of lift capacity.

compare for yourself:

KOEHRING MODEL	SIZE DIPPER	KOEHRING LIFT CAPACITIES (Crawler ratings based on 75% of tipping load. Rubber-tired machines — 85% of tipping load)		PRICE PER POUND OF LIFT CAP.*
205 CRAWLER	½-Yd.	20,000 lbs.	30-foot boom at 10-ft. radius	?
205 ON RUBBER	½-Yd.	30,000 lbs.	25-foot boom at 12-ft. radius	?
304 CRAWLER	¾-Yd.	27,800 lbs.	35-foot boom at 12-ft. radius	?
304 ON RUBBER	¾-Yd.	50,000 lbs.	30-foot boom at 10-ft. radius	?
405 CRAWLER	1-Yd.	40,000 lbs.	40-foot boom at 12-ft. radius	?
605 CRAWLER	1½-Yds.	72,300 lbs.	50-foot boom at 12-ft. radius	?
1005 CRAWLER	2½-Yds.	159,000 lbs.	50-foot boom at 12-ft. radius	?

Figures available on request—ask your Koehring distributor to see them.



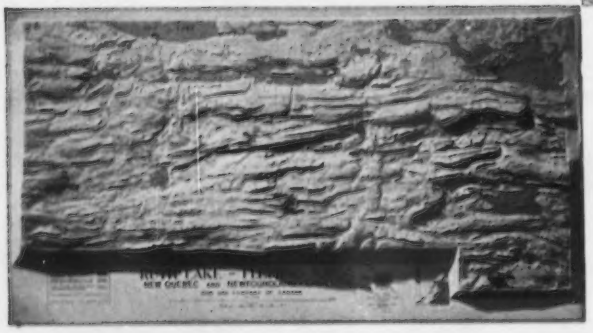
K830

KOEHRING COMPANY Milwaukee 16, Wis. Subsidiaries: JOHNSON PARSONS • KWIK-MIX

Important mineral finds are being uncovered by Aero clients with the airborne magnetometer

Precise aerial mosiacs provide valuable reconnaissance and planning data

Accurate Aero topographic maps aid engineering development

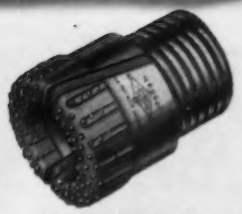


Light weight, plastic relief models give Aero maps a 3rd dimension for management

AERO's modern mining tools are cutting exploration and mapping costs . . . helping to locate new deposits of magnetite, ilmenite, nickel and asbestos . . . and putting schedules months and even years ahead. AERO maps are delivered speedily, and are so accurate, mining engineers are using them for plotting boreholes, property lines, rail spurs, access roads, power lines, and other phases of planning and development. Call on 6 years' experience of AERO—pioneer and leader in aerial surveys.

AERO SERVICE CORPORATION
PHILADELPHIA 20, PA.
Oldest Flying Corporation in the World

Lake Shore mining equipment



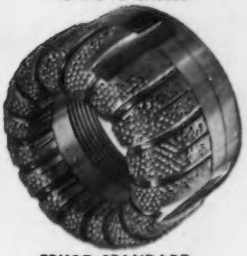
TRUCO CORING BIT

TRUCO CONCAVE BLAST HOLE BIT

TRUCO PILOT BIT

TRUCO IMPREGNATED CORING BIT

TRUCO REAMING SHELLS



TRUCO STANDARD OIL FIELD BIT

FINEST QUALITY DRILL BORTZ

The Charm of Booie, The Witch Doctor

Booie, the Kaffir witch doctor, didn't want to part with the charm. Often he had made big magic with it in his ceremonial dances and without it he might lose face. And, didn't it have miraculous powers?

Schalk van Niekirk, the old Boer trader, thought so—at least it had the power to make him a very wealthy man, for this pebble was four times the size of the one he had sold two years before.

So, all day long they haggled and Schalk brewed pot after pot of Dutch coffee, heavy with sugar, well flavored with a magical potion from a stone bottle and served it with the free hand of a man who feels a fortune tickling his fingertips.

Finally, he stood up, stamped out the fire and said, "Booie, come to my kraal and I will give you 500 sheep, 10 oxen, and a horse—I have nothing more." Booie held out his hand; suddenly, he was incredibly rich.

Schalk sold the big diamond—it weighed 83½ carats—for $56,000, a handsome fortune in 1870. In London, after cutting to 46½ carats, it proved to be of the finest color and brilliance, and the Countess of Dudley gladly paid $125,000 for it. In her tiara it became "The famous Dudley Diamond."

Diamonds are precious in drilling, too, because they provide the vital, time-saving, cost-reducing element in Truco Diamond Bits. They assure that irresistible cutting power which takes Trucos through any formation, swiftly, accurately, thriftily, dependably. Have you consulted your Truco Diamond Bit Catalog lately?

TRUCO DIAMOND BITS

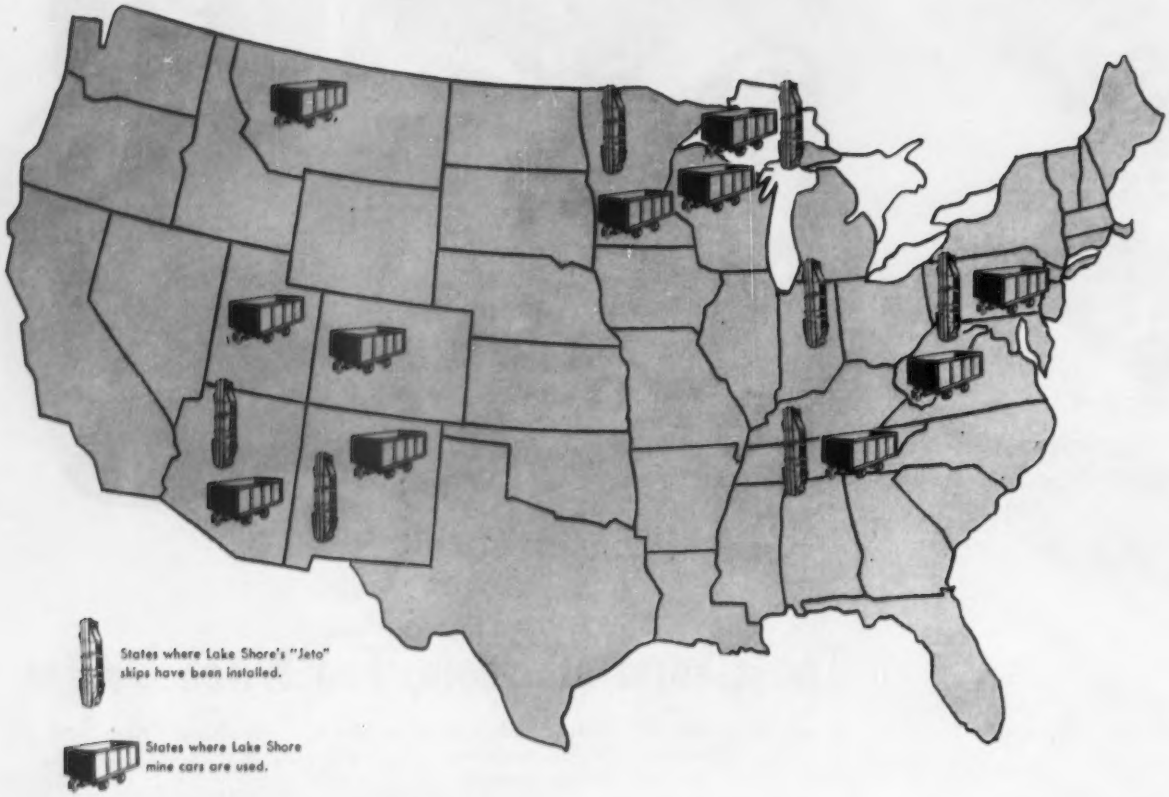
by

WHEEL TRUEING TOOL COMPANY

3200 W. Davison Avenue, Detroit 38, Michigan

WHEEL TRUEING TOOL CO. OF CANADA, LTD.
575 Langlois Avenue, Windsor, Ont., Canada

Lake Shore mining equipment in operation across the nation—



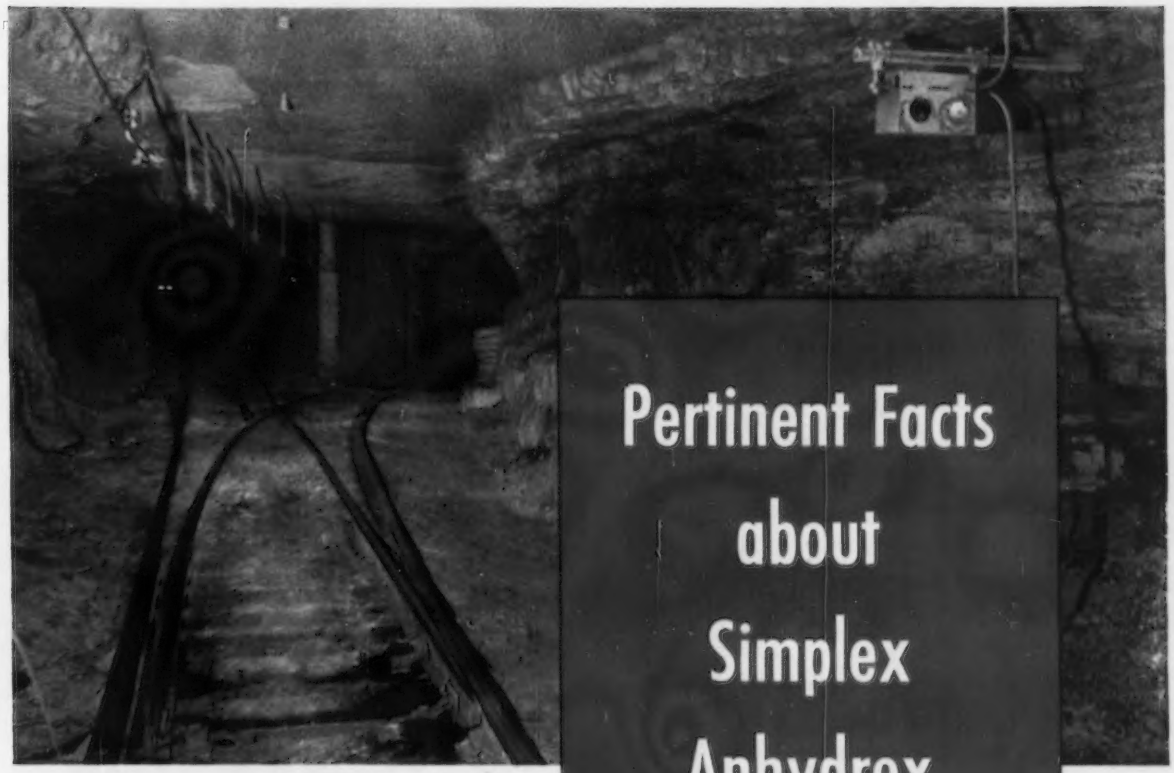
Lake Shore's "Jeto" bottom-dump skips and "Lohed" mine cars are in operation in mines across our nation, in Canada, and other parts of the world. Mine operators from Pennsylvania to Arizona, from West Virginia to Montana, and in distant places such as Peru, and Zonguldak, Turkey, have found that this Lake Shore equipment improves their production, efficiency, and safety record.

The "Jeto's" lightweight aluminum and steel construction, and its cleaner, faster bottom-dump action, increases payloads . . . boosts production. Rounded corners and simple rugged construction make the all welded "Lohed" mine car a durable, long-lasting piece of equipment . . . easy to maintain. Write for product bulletins giving full details and specifications.

LAKE SHORE
Engineering Company

IRON MOUNTAIN 4, MICHIGAN
Plants: Iron Mountain and Marquette, Michigan

FINEST QUALITY
DRILL BORTZ



Pertinent Facts about Simplex Anhydrex Mine Signal Cables

Anhydrex insulation was built to do away with lead sheaths on cables. It has given many years of service in wet mines. No Anhydrex-insulated cable has ever failed because of water absorption.

Anhydrex insulation resists heat and oxidation. This means exceptionally long life for Simplex Mine Signal Cables. These cables have a low power factor and a low dielectric constant.

Simplex Mine Signal Cables have an extraordinarily tough neoprene jacket for protection against acids, flame, oils, cuts, bruises and rough treatment during installation.

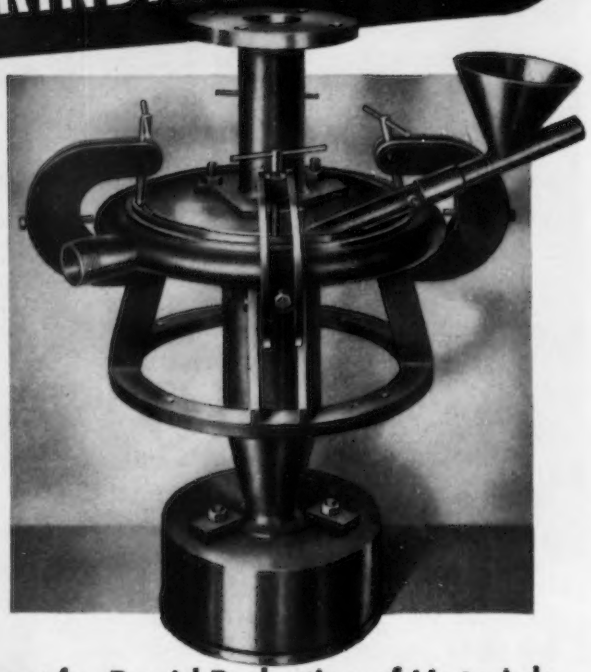
Simplex

If you need help in solving your signal cable problems, call a Simplex representative in the Simplex office nearest you. Or write to the address below for more detailed information about Simplex-ANHYDREX Mine Signal Cables.

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge 39, Mass.

Sturtevant

MICRONIZER* GRINDING MACHINE



Reduces Solids to Micron Sizes

The new Sturtevant *Micronizer* grinding machine is a fluid jet grinder especially designed to reduce solid materials to particle sizes in the micron ranges.

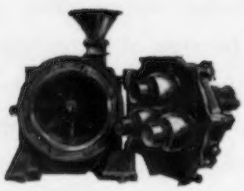
Sturtevant *Micronizers* are used for simultaneous dry grinding and classification of solids. The variety of materials that can be processed is large and includes both metallic and non-metallic minerals and ores, metals, pigments, insecticides, fungicides, pharmaceuticals, plastics, dyes and numerous other organic and inorganic products. Available in capacities from ½ to 3000 pounds per hour.

Other Sturtevant Pulverizing Equipment for Rapid Reduction of Materials...

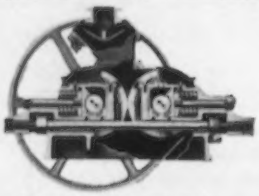
Especially Applicable for Initial Grinding of Products for the Micronizer Mill

ROTARY FINE CRUSHERS for intermediate and fine reduction (down to ¼"). Open door accessibility. Soft or moderately hard materials. Efficient granulators. Excellent preliminary Crushers preceding Pulverizers.

JAW CRUSHERS for coarse, intermediate and fine reduction of hard or soft substances. Heavy or light duty. Cam and Roller action. Special crushers for Ferro-alloys. Several types, many sizes.



RING-ROLL MILLS for medium and fine reduction (10 to 200 mesh), hard or soft materials. Very durable, small power. Operated in closed circuit with Screen or Air Separator. Open door accessibility. Many sizes. No scrapers, plows, pushers, or shields.



CRUSHING ROLLS for granulation, coarse or fine, hard or soft materials. Automatic adjustments. Crushing shocks balanced. For dry or wet reduction. Sizes 8 x 5 to 38 x 20. The standard for abrasives.

SWING-SLEDGE MILLS for coarse and medium reduction (down to 20 mesh). Open door accessibility. Soft, moderately hard, tough or fibrous substances. Built in several types and many sizes.

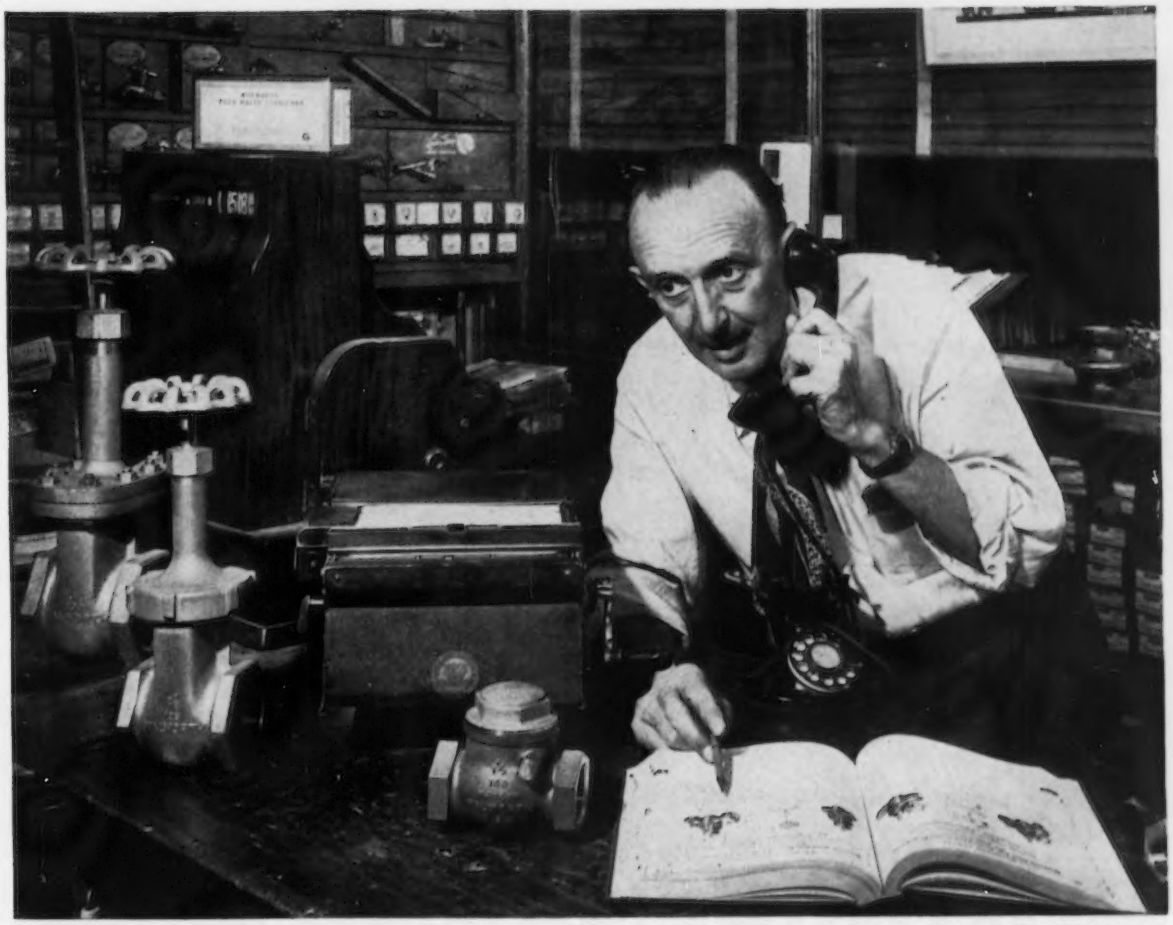
AIR SEPARATOR for separation of fines to 325 mesh and finer. Increases output from 25% to 300%...lowers power costs by 50%. Capacities ¼ to 50 tons per hour output.

*Registered trademark of the Sturtevant Mill Company

STURTEVANT MILL COMPANY

CLAYTON STREET, BOSTON 22, MASS.

DESIGNERS & MANUFACTURERS OF DENS AND EXCAVATORS • MIXERS • SCREENS • PULVERIZERS • ELEVATORS • AND COMPLETE FERTILIZER UNITS



*Fictitious name used to typify over 400 Walworth Distributors

Here's why it pays to do business with distributors like Mr. Hansen*

Andy Hansen is typical of Walworth Distributors throughout the nation. He has been a distributor of Walworth Valves and Fittings for years. Like Andy, the Walworth Distributor in your area provides these services and savings:

He reduces your inventory costs. He's aware of the valve and fitting needs peculiar to his area. He stocks the products that will best serve your needs. Deliveries are always prompt and economical – emergency orders can generally be delivered within hours.

He offers you application and engineering assistance. His technical experience can be invaluable in solving your particular problems. He has 50,000 Walworth products at his disposal. You can be sure that the items he recommends are exactly right for the job.

He is a double guarantee. His business depends upon providing you with the very finest products and unsurpassed service. Every valve and fitting is backed by his own reputation and that of Walworth – a complete line manufacturer.

There's a Walworth Distributor near you ready to help. Call on him today.

WALWORTH

valves . . . pipe fittings . . . pipe wrenches

60 East 42nd Street, New York 17, N. Y.

Walworth Company of Canada, Ltd., Toronto

drilling for 400,000

KW of electricity...

Some 200 miles north of Sao Paulo, Brazil, Ebasco Services is engineering and constructing the Peixoto Hydro Electric Development, for Cia. Paulista de Forca e Luz. When completed, the harnessed waters of the Rio Grande will furnish 400,000 KW of electricity for the industrial development of the area.

To build the dam and accessways to it, meant moving many hundred tons of earth and rock — and for that big job Crucible Hollow Drill Rods were chosen. Experienced construction men *know* they can depend upon these rods for *optimum* performance *at lowest cost per foot of hole drilled.*

That's because Crucible Hollow Drill Rods are built to *tool steel* standards, by the leading producer of tool and special purpose steels. That means fewer broken rods or valuable bits lost on the job. So be sure that on your drilling jobs you specify Crucible Hollow Drill Rods. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 30, Pa.*

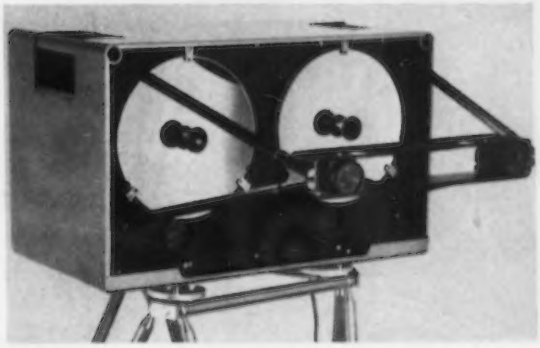
CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

74 NORDBERG GRINDING MILLS

E&MJ NEW PRODUCTS DIGEST

PRESHAPED FOLDS OF ELASTIC MATERIAL join rubber-clad, bent steel strips to form flexible conveyor belt.



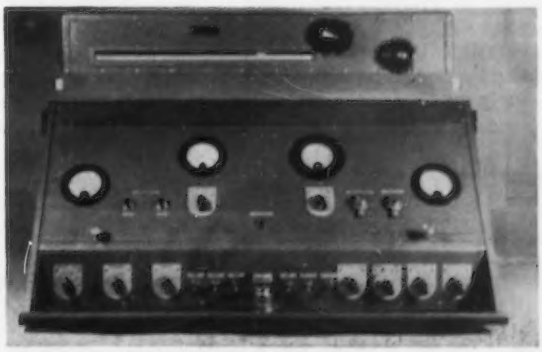
REFLECTION OF LIGHT between mirrors of instrument and distant point is used to measure distance precisely.

Unusual European Developments Show Promise

The "Faltenband" is a belt conveyor that can twist and turn in three dimensional curves, including up a spiral, and can discharge at any point simply by elevating one side. It is made by Albert Stuebbe, Vlotho-Weser, Kalldorf, West Germany. Belt itself is made in sections about 2½-ft long. Each section consists of trough-shaped steel strips rubber-clad on top and connected by flexible material that is preformed to make a cross-fold. This fold gives the belt the ability to bend in any direction. Belt sections are bolted at each end to a carrier and to each other. Carrier is on small wheels which run in channels along each side. Upper channel is for loaded belt, lower for return. Channels are supported by trestles. Continuous, long-link chain is attached to each carrier linking the sections into one unit. Chain is pulled by an electric-motor driven sprocket. The belt can travel in either direction. Return belt can also be mounted side by side with loaded belt. Intermediate drives can be supplied as well. **(1)**

The "Geodimeter" is a surveying instrument that uses the speed of light to measure distance. The electronic-optical device is made by AGA Gasaccumulator Co., Stockholm, Sweden. In it, a source emits light, intensity of which varies at high frequency. Light is reflected back from distant mirror and observed by photocell, sensitivity of which varies with same frequency as emitted light. Time lapse caused by distance light must travel provides scale for measuring. Larger model (below) is designed for up to about 25 miles. Distance must be known within about ½ mile. Accuracy is 1/500,000 and up. Transmitter-receiver assembly, including electric generator, weighs 250 lb; can be broken into portable units. Newest model (above) has less accuracy and range but mounts on tripod and weighs only 70 lb complete. Several distant point mirrors have been developed, all weigh under 50 lb. Larger model cut field work to 2 or 3 hr at night and calculations to 30 minutes. Newer one is even faster. Apparatus is designed for field use in all terrain. **(2)**

SPROCKET DRIVES CHAIN pulling carriers on tracks.



DIRECT READING is given by adjusting to null point.

70 NORDBERG GRINDING MILLS and 37 SYMONS® CONE CRUSHERS for processing TACONITE in the Lake Superior Iron Ore Region...

SYMONS® CONE CRUSHERS and NORDBERG GRINDING MILLS have long proved their efficiency, dependability and economy in the profitable reduction of ores and minerals the world over. In the case of *TACONITE*, one of the hardest and toughest of all ores to process, the mining fraternity again depends on Symons Cone Crushers and Nordberg Grinding Mills for the economical production of large tonnages of fine crushed and milled product . . . as evidenced by the fact that, following extensive tests and research in pilot plants, 37 Symons Cones and 70 Nordberg Rod and Ball Mills were recently ordered for delivery to the mammoth reduction works now under construction in Northern Minnesota.

The thirty-seven Symons Cone Crushers . . . all Super Heavy 7-foot types, have been given the difficult assignment of secondary and tertiary crushing of the hard, tough Taconite Iron Ores. The seventy Nordberg Rod and Ball Mills were selected to meet the exacting requirements for primary and secondary grinding. Included are 33 rod mills—twenty-nine 10′ x 14′ units and four 10′ x 16′ units . . . as well as a total of thirty-seven 10′ x 14′ ball mills.

Thus, in Taconite operations . . . *as in all of the great ore and industrial mineral operations the world over . . .* NORDBERG MACHINERY is the outstanding preference among leading producers for processing great quantities of finely crushed and ground product at low cost.

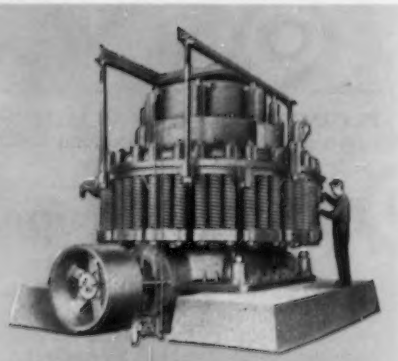
Write for further information on the machinery you need.

NORDBERG MFG. CO., Milwaukee, Wis.

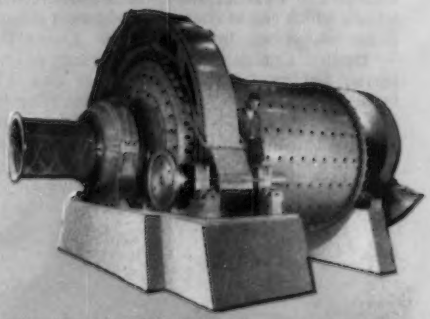
SYMONS . . . A REGISTERED NORDBERG TRADEMARK KNOWN THROUGHOUT THE WORLD

©1955, Nordberg Mfg. Co.

M255



SYMONS CONE CRUSHERS . . . *the machines that revolutionized crushing practice* . . . are built in Standard, Short Head and Intermediate types, with crushing heads from 22" to 7′ in diameter, in capacities from 6 to 900 tons per hour. Shown is a 7′ Super Heavy Unit as used for Taconite service.



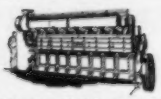
NORDBERG GRINDING MILLS are built in ball, rod, tube, pebble and compartment types for practically all wet and dry grinding operations. Shown is one of the 10′ x 14′ Ball Mills for Taconite service.

SYMONS GYRATORY CRUSHERS

NORDBERG KILNS and COOLERS

SYMONS VIBRATING GRIZZLIES and SCREENS

NORDBERG MINE HOISTS



NORDBERG DIESEL—DUAFUEL® and SPARK-IGNITION GAS ENGINES

NORDBERG MACHINERY

NORDBERG

CRUSHERS SYMONS SCREENS NORDBERG

MACHINERY FOR PROCESSING ORES and INDUSTRIAL MINERALS

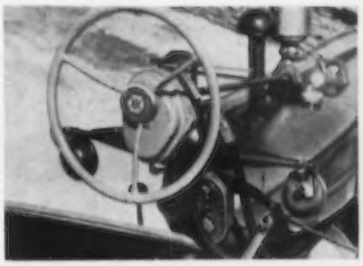
NEW YORK • SAN FRANCISCO • DULUTH • WASHINGTON
TORONTO • MEXICO, D.F. • LONDON • JOHANNESBURG

HARDFACING ALLOY (33)

Low-cost hardfacing welding electrodes are now available form Wall Colmonoy Corp., Detroit, Mich. The iron base chrome-molybdenum-silicon alloy is called Colmonoy No. 2 and was developed as a low cost material for earthmoving and handling machinery where heavy build-up and crack-free deposits are not demanded. It is said to have excellent weldability.

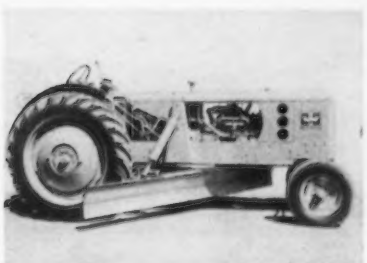
MAP FILE (34)

An expandable map and drawing file is now made by Pack Manufacturing Co., Logan, Utah. Interlocking tubes, 2½ in. square by any desired length, dovetail together to form blocks of any size or shape. Tubes can be withdrawn without disturbing the block. The company claims twice as many drawings can be stored in half the space of other systems. Each tube has door and label.



POWER STEERING DEVICE (35)

Capable of being installed on virtually all existing vehicles without making structural changes is the claim made for the power steering unit produced by Westinghouse Air Brake Co., Wilmerding, Pa. The hydraulic device is designed to cut driver fatigue on off-the-highway trucks, loaders, etc. It is installed at the steering wheel in two or three hours.



ROAD GRADER (37)

Latest "Maintainer" features power sliding moldboard and torque convertor as standard equipment. Moldboard is said to mean no deviation from line of travel as operator approaches abutments or posts. Either gasoline or diesel power is available. Cab is standard equipment but it can be removed in warm weather. Made by Huber-Warco Co., Marion, Ohio, it has versatile uses.

UNIVERSAL JOINT (38)

Called the "Rzeppa OV," small universal joint provides for turning of shaft without any speed fluctuations. Six steel balls in grooved raceways transmit torque by free rolling action. Sold by Gear Grinding Machine Co., Detroit, Mich., the cylindrical shaped device allows normal maximum operating angle of about 20 deg. Smallest size has 2⅛-in. outside diameter and is for ½-in. shaft.

RR SUPPLY CAR (39)

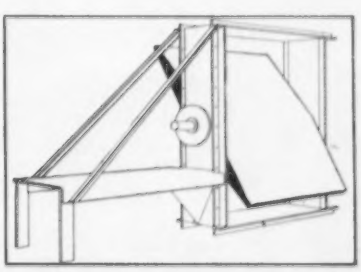
Easily unhooked into two 70-lb sections for convenient handling, the railroad cart made by the Nolan Co., Bowerston, Ohio, is said to be ideal for carrying tools and supplies. Each half can be used as seat when going to job in truck. Handle is removable and can be used on either end. The 1-ton capacity car has tubular frame, mesh platform and ball bearing wheels.

COAL-TYPE DRILL (41)

Lighter and faster are the advantages claimed for the Class A9A hand held rotary drill made by the Jeffery Manufacturing Co., Columbus, Ohio. Designed for use with coal-type face equipment, the machine weighs 25 lb, has an aluminum housing and is powered by an axial piston type hydraulic motor.

ROTARY SHAFT SEAL (40)

Mechanipak BB-21A seals are furnished assembled, ready to slip on any rotary shaft. For use at any pressure up to 150 psi, they are cylindrically shaped devices made of brass containing a spring loaded bellows of various rubber compounds. Garlock Packing Co., Palmyra, N. Y., is the maker. Sizes vary from ⅜ to 3 in.



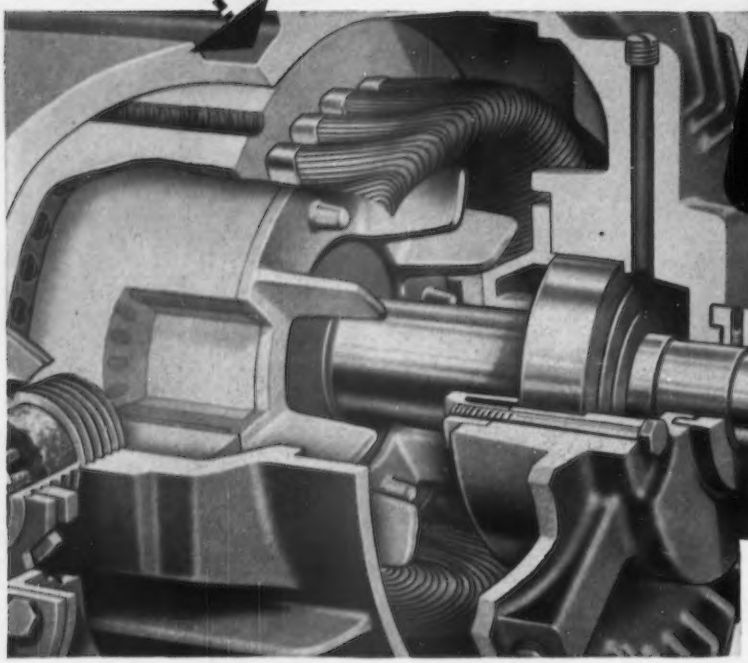
CLINKER COOLER DEVICE (43)

Better fuel economy and steadier kiln operation result from the use of a new pulsating damper for their "Air Quenching" clinker cooler according to Allis-Chalmers Manufacturing Co., Milwaukee, Wis. The rotating vane, installed in the air duct between fan and cooler sends pulses of air through clinker grate.

ANTI-FOAMING AGENT (42)

General Electric Co., Waterford, N. Y., has developed Anti-Foam 60, a low-viscosity silicone emulsion that does not require premixing with water, for use in aqueous foaming systems. It is reputed to eliminate the handling problems associated with conventional pasty agents, yet retains the usual benefits.

Get Both
bearing features

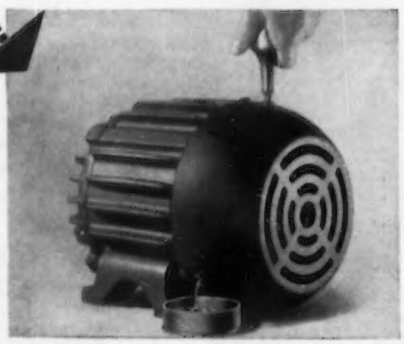


fully enclosed and protected

The bearing cap is held tightly in place against the inner face of the bearing enclosure. This cap, with its close running clearances, keeps grease from the interior of the motor . . . retains an ample supply within the bearing enclosure.

At the outer side of the bearing, double labyrinth seals keep grease in, also keep dirt out. What's more, large grease reservoirs act as additional dirt traps.

. . . *yet* easy to grease



You can lubricate the bearings without dismantling the motor. Pipe-tapped holes in the bearing housings at three points provide both means for inserting new grease and a means of flushing out old grease.

Look for the extra bolts on the end housing . . . the sign of greater value. Ask your Allis-Chalmers representative or Authorized Distributor to show you a cutaway section of this maintenance-cutting design. Or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 51B7225.

A-4609

ALLIS-CHALMERS

CAR SHUNTER (51)

Capable of moving railroad cars up to 100 tons total weight, the gasoline powered JLO single-wheel shunter can be driven over rails and rough ground and can be used no matter what the position of the cars. Made by JLO Werke, Pinneberg/Hamburg, Germany, the machine requires only one man to operate. Handles swivel to allow control from side or rear.

URANIUM DETECTOR (52)

A low-cost kit that uses the fluorescent property of uranium compounds to detect their presence is announced by CMG Industries, Laramie, Wyoming. Window in top of bag-like chamber filters sunlight which excites sample held inside. Sample is observed through eye-hole next to window. Chemicals make fused bead of ore not naturally fluorescent.

GEOPHYSICAL TOOL (53)

A neutron generator and scintillation spectrometer assembly for probing drill holes has been developed by McCullough Tool Co., Los Angeles, Calif. Neutron bombardment produces radioactivity which is recorded and, it is claimed, permits accurate determination of nature and quantity of elements present in various formations penetrated.

INDUSTRIAL MICROPHONE (54)

Femco Inc., Irwin, Pa., has introduced a microphone particularly designed for applications where background noise, dust and moisture are present. Known as MI-2630 series, the close talking "mike" is offered for use with wire or radio systems. Thick bakelite shell is tough and designed to fit hand comfortably. All parts are sealed off from atmosphere.

LEVEL ATTACHMENT (55)

A gradient device for attaching to a regular level is available from Carr Manufacturing Co., Ionia, Mich. It is said to rival a transit for accuracy in establishing and checking grades. Made of 16-gage steel, corrosion resistant plated, it is simple to adjust, will measure as little as ⅛-in. fall in 10 feet, and is readily put on or taken off.

HOSE CLAMP (56)

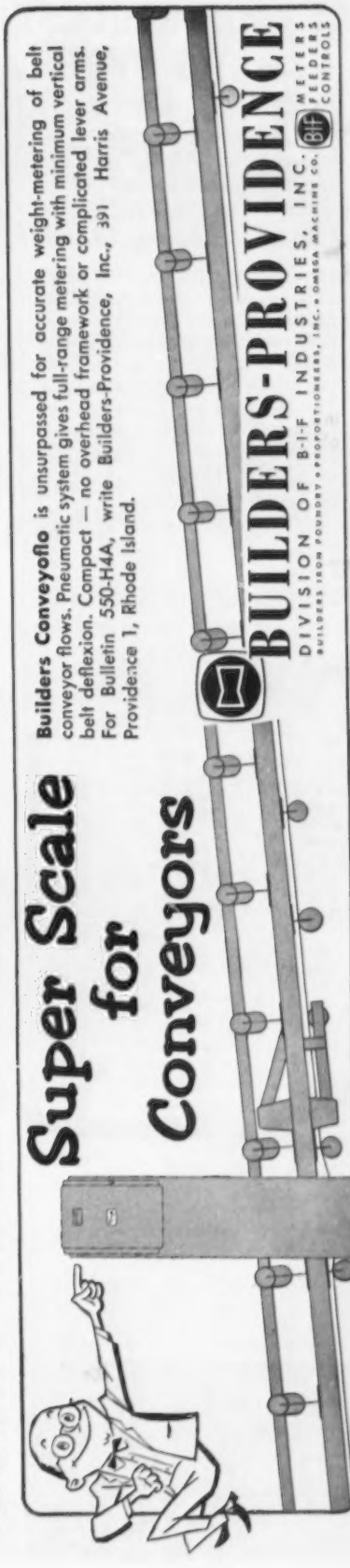
Simply squeezing lugs with ordinary pincers fastens this clamp to hose. Manufactured by Circle Clamp Corp., New York, N. Y., they are reported to have lasting and high pressure positive clamping action under extreme internal hose pressure, hose movement and rough usage. They are available in sizes from ¼ to 2⅝ in. ID of various metal alloys.

GAS ENGINE (57)

"Timeline 168," a 20-bhp 2-cylinder engine, is designed to run continuously for a year without service, according to release from Minneapolis-Moline Co., Minneapolis, Minn. Radial cooling system eliminates conventional radiator and accessories by using unit built into flywheel. Weight is 2150 lb. Present models use natural gas fuel. Models are planned to use LP gas.

URANIUM STANDARDS (58)

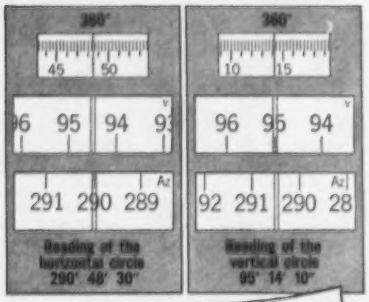
"Radiassay" is a set of seven calibrated uranium ore samples for use in assaying by comparative analysis with radiation detectors. The packaged kit prepared by Applied Research Co., Inc., Phoenix, Arizona, also contains a mortar and pestle for crushing unknown ore, two empty vials to place crushed ore in, and an instruction booklet describing procedure.


Super Scale
for
Conveyors
Builders Conveyoflo is unsurpassed for accurate weight-metering of belt conveyor flows. Pneumatic system gives full-range metering with minimum vertical belt deflexion. Compact — no overhead framework or complicated lever arms. For Bulletin 550-H4A, write Builders-Providence, Inc., 391 Harris Avenue, Providence 1, Rhode Island.
BUILDERS-PROVIDENCE
DIVISION OF B-I-F INDUSTRIES, INC.
BUILDERS IRON FOUNDRY • PROPORTIONEERS, INC. • OMEGA MACHINE CO.
METERS
FEEDERS
CONTROLS

AT YOUR REQUEST IT'S HERE...

The NEW 20" Reading WILD HEERBRUGG T-1 OPTICAL *Repeating* TRANSIT

In answer to many requests, available now as an alternative to the Standard Model (reading direct to 1', interpolation to 6"). The New Model WILD T-1 Optical Repeating Transit gives direct reading to 20" on both circles, easy interpolation to 10" (as shown below).



The WILD T-1, with years of proven service under all field conditions, is the most widely used modern transit because it offers you: - full behind-instrument operation, a built-in optical plummet for fast set-up, an optical micrometer reading system which eliminates possibility of error. It sets on zero and repeats angles. Illumination is provided by daylight mirror or battery attachment for night, tunnel or mine work. Made by the world's largest surveying instrument manufacturers and backed by full factory service here.

T-1 TRANSIT $718
Reading direct to 20 seconds, interpolation to 10 seconds.

T-1 TRANSIT (Standard Model) $700
Reading direct to 1 minute, interpolation to 6 seconds.

(All Model Tripods Extra)

PRICES F.O.B. PORT WASHINGTON, N. Y.

For details phone or write for Booklet MJ 8

WILD HEERBRUGG INSTRUMENTS INC.
MAIN & COVERT STS., PORT WASHINGTON, N. Y.
PORt Washington 7-4843

E&MJ NEW PRODUCTS DIGEST

PIPE CHUCK (45)

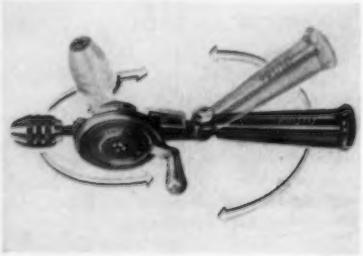
"Spin Torque" made by Toledo Pipe Threading Machine Co., Toledo, Ohio, holds pipe or rod by spinning wheel. Special rocking wedge jaws make hammering unnecessary. Diagonal serrations prevent slipping in any direction.

POWER RADIATION LOGGER (46)

Jeep mounted equipment developed for AEC by Bogue Electric Mfg. Co., Sherman Oaks, Calif., logs radioactivity in deep drill holes. Scintillation counter uses 3-in.-diameter probe lowered by cable boom. It is now publicly available.

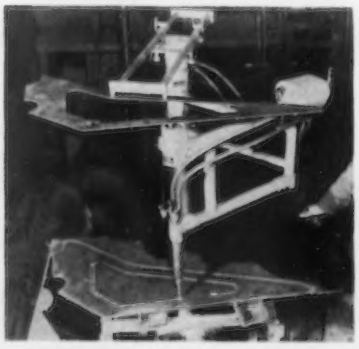
BELT REPAIR MATERIAL (47)

Chemical process makes REMA a self-vulcanizing rubber repair material which eliminates the need for heat or pressure in repairing bruises, tears or edge damage to conveyor belts, according to release from Flexible Steel Lacing Co., Chicago, Ill. No curing time lets belt go back into service immediately. Repair is sealed with abrasive-resistant cover stock.



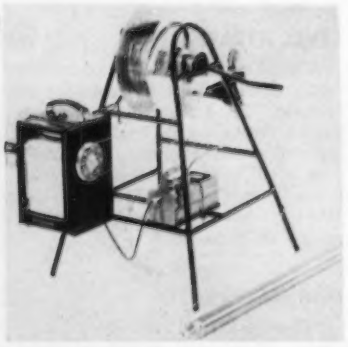
HAND DRILL (48)

Design of "Proto" all-angle drill solves difficult drilling problems says Plomb Tool Co., Los Angeles, Calif. Both chuck and handle are adjustable to varous angles for reaching around obstructions and working in close quarters. Chuck, ¼-in. size, has thumb spring-lock for clamping through 270-deg arc. Handle turns arc of 180 deg at right angles to chuck path.



OXYGEN CUTTING MACHINE (49)

Smaller shops can now mechanize with low cost "UltraGraph" says Heath Engineering Co., Ft. Collins, Colo. The oxy-acetylene cutting torch is guided by small Alnico permanent magnet rolling along edge of metal pattern directly above.



CRANK RADIATION LOGGER (50)

"Scintillogger" developed by Radiac Co., N. Y., N. Y., is a self-contained unit for measuring radioactivity in deep drill holes to 6000 ft. It consists of 2-in.-diameter probe, cable reel with crank, counter, recorder and stand.

Model D *Standard* (GASOLINE ENGINE)

STANDARD EQUIPMENT: Six-volt electrical system, two headlights, one rear and stop light, muffler, 10-ft by ⅝-in. moldboard, hydraulic controls for moldboard lift, four 7.50-20 rear and two 6.50-16 front tires with tubes.

Total weight	8,800 lb	Blade pressure	4,900 lb
Wt. on front wheels	2,700 lb	Four speeds forward to	25.6 mph
Wt. on rear wheels	6,100 lb	Reverse to	3.3 mph

Model D *Special* (GASOLINE ENGINE)

FULLY EQUIPPED AS FOLLOWS: Six-volt electrical system, two headlights, one rear and stop light, muffler, 10-ft by ⅝-in. hydraulically shiftable moldboard, 6-valve control group, four 8.25-20 rear and two 8.25-20 front tires with tubes, front wheel lean, power circle turn, hydraulic scarifier, all-steel cab.

Total weight	10,900 lb	Blade pressure	6,450 lb
Wt. on front wheels	3,750 lb	Scarifier pressure	4,900 lb
Wt. on rear wheels	7,150 lb	Four speeds forward to	25.6 mph
		Reverse to	3.3 mph

Match your grading needs with new economy and efficiency

From the Allis-Chalmers Model D motor grader line

Both gasoline and diesel Model D's are available with any combination of accessories.

Model D Diesel *Standard*

STANDARD EQUIPMENT: Twelve-volt electrical system, two headlights, one rear and stop light, muffler, 10-ft by ⅝-in. moldboard, hydraulic moldboard lift controls, four 7.50-20 rear and two 6.50-16 front tires with tubes.

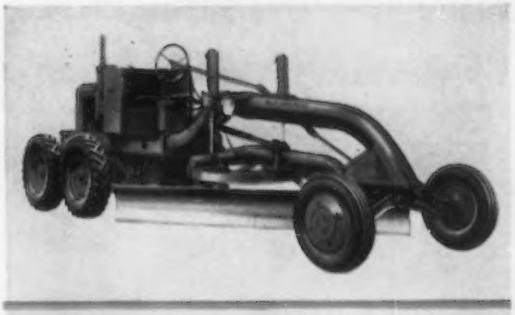
Total weight	9,350 lb	Blade pressure	4,900 lb
Wt. on front wheels	2,760 lb	Four speeds forward to	25.2 mph
Wt. on rear wheels	6,590 lb	Reverse to	3.2 mph

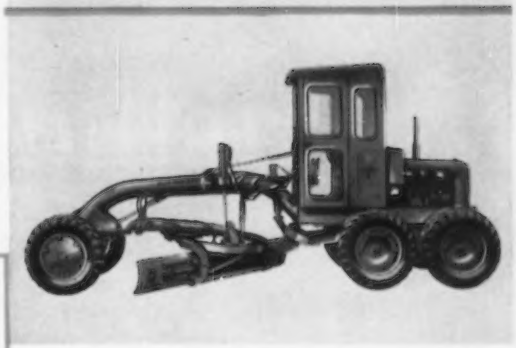
Model D Diesel *Special*

FULLY EQUIPPED AS FOLLOWS: Twelve-volt electrical system, two headlights, one rear and stop light, muffler, 10-ft by ⅝-in. hydraulic shiftable moldboard, 6-valve control group, four 8.25-20 rear and two 8.25-20 front tires with tubes, front wheel lean, power circle turn, hydraulic scarifier, all-steel cab.

Total weight	11,450 lb	Blade pressure	6,450 lb
Wt. on front wheels	3,750 lb	Scarifier pressure	4,900 lb
Wt. on rear wheels	7,700 lb	Four speeds forward to	25.2 mph
		Reverse to	3.2 mph

You can still buy a model D for one-third the cost of a large motor grader, and it's the most popular, most versatile small grader on the market. In addition to the units illustrated, the Model D is available with other combinations of accessories . . . or with any of these useful attachments: rear-mounted ⅝-cu-yd loader; shoulder maintainer; one-pass windrow eliminator; V or blade-type snowplows. Ask your nearby Allis-Chalmers dealer for a demonstration . . . and prove the Model D's value.

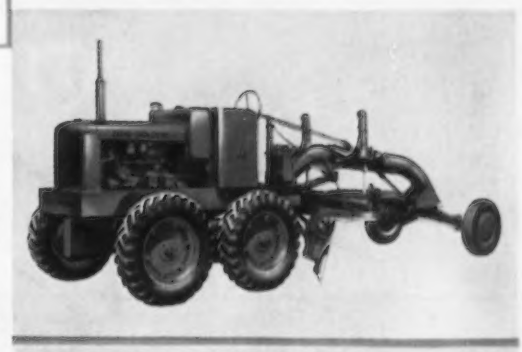


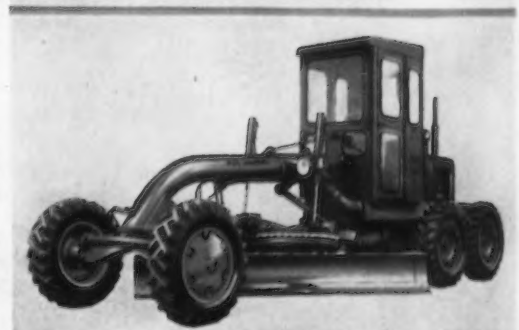


NOW AVAILABLE WITH YOUR CHOICE OF TWO OUTSTANDING ALLIS-CHALMERS ENGINES

50 - hp **POWER-CRATER** gasoline engine

50 - hp diesel engine with follow-through combustion

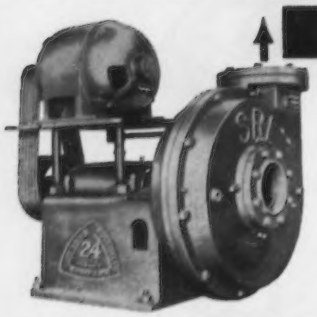




POWER-CRATER is an Allis-Chalmers trademark.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

DENVER Pumps Save You Many Dollars In Power, Maintenance and Continuous Operation



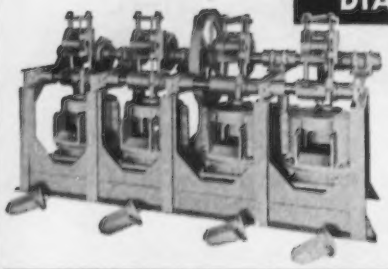
SRL SAND PUMPS

DENVER SOFT RUBBER LINED SAND PUMPS lower pumping costs 30% to 70% due to simple design, lighter weight and accuracy of rubber parts which increase efficiency 1½ to 3 times over other sand pumps.

Denver Soft Rubber Lined Pumps have molded rubber impellers and casing liners for long life.

Size	Gals. of Water per Minute		20′ head	40′ head	60′ head	80′ head	100′ head
2″ x 2″	50	RPM	838	1090	1320	1525	
SRL		HP	.60	1.5	2.8	3.2	
3″ x 3″	100	RPM	760	1053	1303	1453	
SRL		HP	1.1	1.9	3.4	4.3	
5″ x 5″	300	RPM	590	800	965	1087	
SRL		HP	2.4	5.4	8.3	11.5	
6″ x 6″	1000	RPM		862	1005	1122	
SRL		HP		14.4	22.6	30.0	
3″ x 3″	150	RPM	870	1145	1385	1580	1745
SRL-C		HP	1.5	3.2	5.3	7.2	9.6
5″ x 4″	350	RPM	655	850	1020	1160	1280
SRL-C		HP	2.9	5.4	8.3	11.4	14.5
8″ x 6″	800	RPM	500	655	780	890	980
SRL-C		HP	5.7	11.6	16.8	22.3	28.6
10″ x 8″	2000	RPM	485	610	710	800	855
SRL-C		HP	14.0	27.8	41.2	56.3	71.6

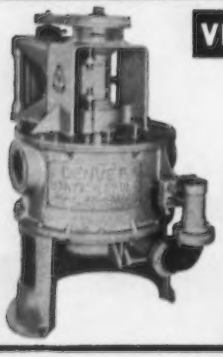
(*Multiply these horsepower ratings by the specific gravity of your pulp to determine actual brake horsepower required.)



DIAPHRAGM PUMPS

DENVER ADJUSTABLE STROKE DIAPHRAGM PUMPS are available in either simplex, duplex, triplex or quadruplex units. Ability to adjust the stroke while pumping makes pump particularly valuable on thickeners. Pumping stroke is vertical and prolongs diaphragm life.

Size	Type	Capacity Cu. Ft. per Min.	Motors H.P.
2″	Simplex	2.42	¾-1
2″	Duplex	4.84	1½-2
3″	Simplex	4.69	1½-2
3″	Duplex	9.38	2-3
4″	Simplex	5.98	1½-2
4″	Duplex	11.96	2-3
5″	Simplex	18.0	2-3
5″	Duplex	36.0	5-7½
6″	Simplex	23.0	3-5
6″	Duplex	46.0	5-7½
6″	Triplex	69.0	10-15
6″	Quadruplex	92.0	15-20



VERTICAL CENTRIFUGAL PUMPS

DENVER VERTICAL CENTRIFUGAL SAND PUMPS are ideal for handling frothy liquid or coarse sandy material. Sizes: ¾″, 1″, 2″, 3″ and 4″. No sump or feed box is required. Handles any material that will flow by gravity. Self priming, no sealing water is required.

Vertical design protects motor from splash. Long service from wearing parts. Handles intermittent flows.

Capacity Based on 25% Solids By Weight

Discharge Head—Vertical Lift Plus Friction Head

Pump Size	Gal. Per Min.	—20 Ft.— RPM	HP*	—30 Ft.— RPM	HP*	—40 Ft.— RPM	HP*	—60 Ft.— RPM	HP*
¾″	15	1975	½	2385	1	.....	....	.....	....
1″	30	1150	¾	1450	1½	1624	2	.....	....
1½″	75	1015	2	1230	3	1410	3	1710	7½
2″	150	1000	3	1200	5	1370	7½	1660	10
3″	225	825	7½	925	7½	1035	10	1250	15
4″	450	690	10	775	15	855	15	1015	20

*Motor Horsepower

SUCTION-PRESSURE PUMPS

DENVER SUCTION-PRESSURE DIAPHRAGM PUMPS solve special problems where elevation is involved. They are also ideal for filtrate pumps or where metered flows are required. Variation of stroke is possible with adjustable eccentric. Available in acid-proof construction if required. Rugged construction makes this pump valuable in many difficult jobs.

Pump Size	Type	Speed Range R.P.M.	Range Stroke	*Capacity—Maximum Stroke—40 R.P.M. Cu. Ft. Per Min.	Gallons Per Min.
¾″	Simplex	40-60	0″ to 1″	0.31	2.3
1¼″	Simplex	40-60	0″ to 1⅛″	0.67	5.0
1¼″	Duplex	40-60	0″ to 1⅛″	1.34	10.0
1¼″	Triplex	40-60	0″ to 1⅛″	2.10	15.0
1¼″	Quadruplex	40-60	0″ to 1⅛″	2.70	20.0
2″	Simplex	40-60	0″ to 1¾″	2.40	18.0
2″	Duplex	40-60	0″ to 1¾″	4.80	36.0
2″	Triplex	40-60	0″ to 1¾″	7.20	54.0
2″	Quadruplex	40-60	0″ to 1¾″	9.60	72.0
4″	Simplex	40-60	0″ to 2½″	5.90	44.0
4″	Duplex	40-60	0″ to 2½″	11.80	88.0
4″	Triplex	40-60	0″ to 2½″	17.70	132.0
4″	Quadruplex	40-60	0″ to 2½″	23.60	176.0

DECO FLOTATION ENGINEERS — DENVER EQUIPMENT 24 HOUR SERVICE COMPANY

"The firm that makes its friends happier, healthier and wealthier"

DENVER EQUIPMENT CO.

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Now...

from Caterpillar

...a major

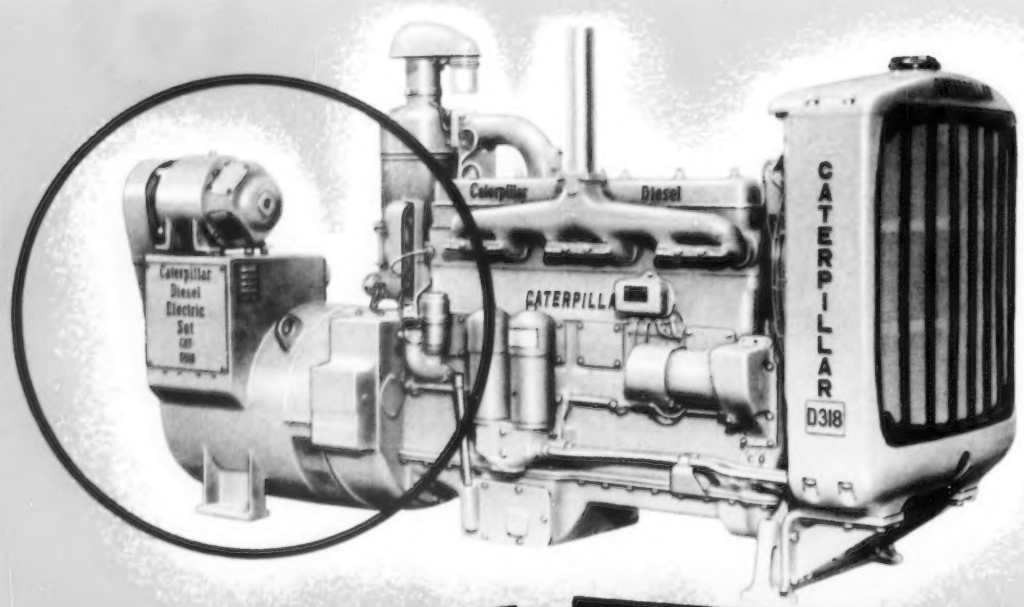
development

in

MODERN ELECTRIC POWER

The new

CATERPILLAR

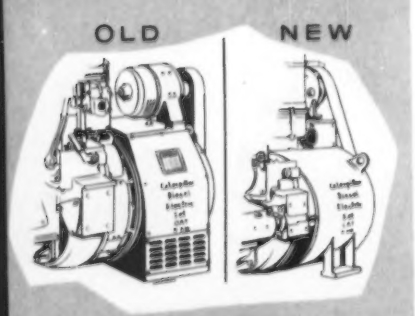


Nothing like it for simple operation, flexible application, compact power, rugged construction, long life and ease of maintenance.

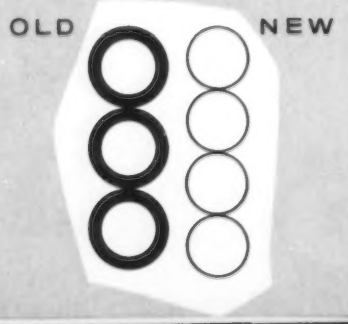
Heart of the new line of Cat Diesel Electric Sets, providing in one package the best features of self-regulated and externally-regulated generator plants—you get more for your money.

Easily paralleled with other generators now in use.

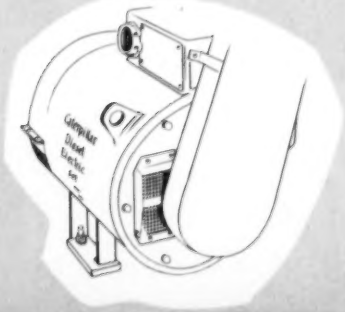
There is a big difference in size between the old and new Caterpillar Generators.



New insulation permits more compact design—exaggerated comparison in illustration below.



New design saves space. Leads can be taken from side, back or top without affecting machine width.



GENERATOR

Here is a new concept in generators – an advance that stems both from Caterpillar research and practical experience in the field of electric power.

Combining latest developments in design, materials and production, it brings to Caterpillar's new line of Diesel Electric Sets the efficiency of the externally-regulated set in a self-regulated set–you get more for your money.

These rugged power packages provide you with many new advantages. Here are a few of many features that add up to a new standard of efficient, economical performance:

- **Close regulation of voltage—no load to full load.**
- **Easy to start—require no operating adjustments. Anyone can run them.**
- **Extremely compact—big electrically, packing more power in smaller space than old style units.**
- **Easily paralleled with other generators now in use.**
- **Like all Caterpillar-built equipment—100% backed by Caterpillar.**
- **Sold and serviced by one reliable source—your nearby Caterpillar Dealer.**

Whatever your power requirements, it will pay you to look into the new Cat Diesel Electric Sets with their advance-design generators. Get the full facts about them from your Caterpillar Dealer.

MAJOR ADVANTAGES OF THE NEW CAT GENERATORS

1 **MATCHED TO ENGINE PERFORMANCE.** Each Cat Generator is designed and built to exactly match the Cat Engine powering it, assuring maximum efficiency in a simple, complete package.

2 **SELF-REGULATING, WITH CLOSE VOLTAGE REGULATION.** Designed to meet the needs of applications now served by self-regulated or externally-regulated generators, this new generator provides steady voltage from no load to full load.

3 **ADJUSTABLE FOR SPECIAL CONDITIONS.** During initial installation, the terminal voltage and voltage "droop" can be adjusted to meet the special conditions of the application. After that, the adjustments are locked and no further adjustments are necessary.

4 **EASY TO INSTALL.** No complicated switchgear or external voltage regulators are needed.

5 **VERSATILE IN APPLICATION.** Easily paralleled with other generators now in use.

6 **SMALL AND COMPACT.** Occupy less space than other generators. A reduction in frame size, close coupling, top-mounted exciter results in a shorter over-all package length.

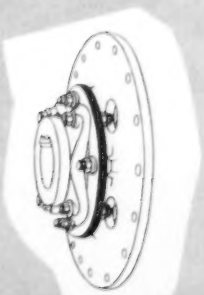
7 **BIG ELECTRICALLY.** Motor starting ability — capacity to handle the surge of heavy loads.

8 **EASY TO MAINTAIN.** Heavy-duty, single-bearing, close-coupled construction. The single bearing is easily accessible and is lubricated from an oil reservoir that requires filling only once a year.

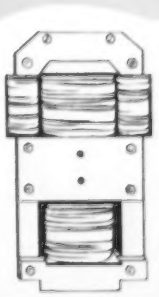
9 **RUGGEDLY CONSTRUCTED.** Heavy-duty, laminated pole rotor for improved operation and increased rotor life.

10 **DESIGNED FOR LONG LIFE.** Built to match the long life of the Caterpillar Engine powering them.

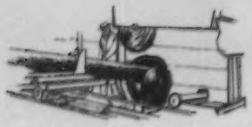
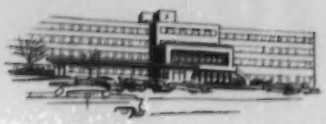
Disc-type coupling and single-bearing design save space. Single bearing is easily accessible.



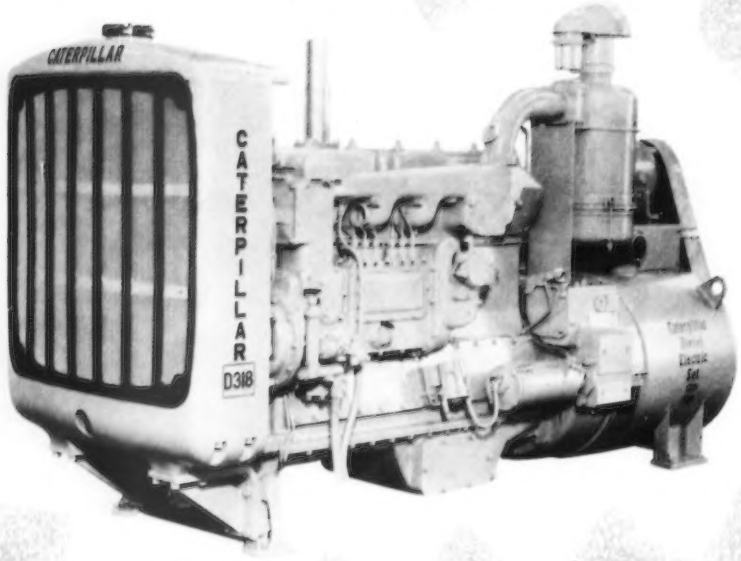
The "regulator" of the Caterpillar Generator. No moving parts — compact — reliable.



The control panel—adjustments locked at installation. No further attention required.

The new CAT* Generator



. . . another example of Caterpillar leadership in action

In 1939, Caterpillar introduced the first Cat self-regulated Electric Set.

At the time, this was a new concept in diesel-electric power.

Like most new developments, it had to win acceptance against "old, hidebound, traditional prejudices and practices."

It won acceptance — quickly and with outstanding success!

Just look at the record: since 1939, thousands of Cat Electric Sets have delivered long, reliable, economical service in widely different applications in every corner of the world. Sets with many thousands of hours of profitable operation are not uncommon. Many with more than 100,000 hours on their meters are still in use and going strong.

No matter how old they grow, not a single one ever becomes a "parts orphan." Like every Caterpillar-built machine, genuine Cat parts will be available as long as you have a need for them.

Now Caterpillar introduces another new concept in diesel-electric power—a new and better generator, heart of the new line of Caterpillar Diesel Electric Sets.

Like that 1939 "new concept of diesel-electric power," this is also backed 100%.

New design, new materials and new production techniques have made it possible for you to get more for your money in the new power packages.

See your Caterpillar Dealer about the new line today!

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

CATERPILLAR*

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NEW HEAVY-DUTY ELECTRIC SETS

MAIL TODAY!

CATERPILLAR TRACTOR CO., Peoria, Illinois, U. S. A.

I'd like more information on the new Cat Generator.

Name _____

Company _____

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City _____ Zone _____ State _____

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E&MJ NEW PRODUCTS DIGEST

CABLE SPLICING TAPES (59)

Okonite Co., Passaic, N. J., has developed a line of rubber and neoprene cable splicing tapes for use with standard steam or electric vulcanizers. They come 1-in. wide and readily fuse together even before vulcanizing for easy application. Designed especially for mine trailing cables, they can also be used for fixed installations.

BOLT LOAD INDICATOR (61)

Stress on structural bolts is accurately set with PLI washer now offered by Standard Pressed Steel Co., Jenkintown, Pa. Placed on bolt between two flat washers, it consists of two concentric steel rings. One fits freely inside the other and is thicker. Nut is tightened until inner ring is compressed to thickness of outer.

SOUND ANALYZER (60)

With industry daily becoming more alert to the necessity for sound control, sound measurement and analysis has been simplified by the recently developed Third Octave Spectrum Analyzer Model BL-2109. It is distributed by Brush Electronics Co., Cleveland, Ohio. A recorder is available for continuous monitoring of noise level.

V-BELTS (62)

An electronic method of making rubber V-belts which produces belts reputed to be almost completely free from vibration and of greater uniformity than ever before, has been developed by United States Rubber Co., New York, N. Y. With the new device, the tension applied to the cord is electronically controlled more precisely.

For Your Files

This informative manufacturers' literature is free unless otherwise specified. To obtain bulletins circle their numbers on card below and mail.

CRANE-SCRAPER RIG assembly described in report issued by Sauerman Bros., Inc., Bellwood, Ill., is said to extend reach of your crane and in many cases doubles its capacity. Layout drawing illustrates the method and on-the-job photos support the promise. **(63)**

FLOTATION INDEX for 1954 is available from Dow Chemical Co., Midland, Mich. The 25th annual supplement gives a list of articles published throughout the world during 1954 on flotation, heavy media separation and other mineral dressing processes. **(64)**

ORE AGGLOMERATION is rather thoroughly covered in a 24-page booklet prepared by Koppers Co., Inc., Pittsburgh, Pa. Presented are fundamental characteristics of processes and detailed descriptions on the entire field of making larger size particles from fine ore. **(65)**

CONTROLLED MAINTENANCE SYSTEMS are promoted in a brochure from a newly-formed consulting group called Fraser, Weir & Associates Inc., Chicago, Ill. The procedure followed by them in accomplishing the cost savings and other important benefits are explained. **(66)**

PHOTOELECTRIC CONTROLS are "Proved Answers to Successful Automation" on any job that depends on seeing and controlling the motion or position of objects, according to a 20-page descriptive pamphlet of that title published by Electronics Corp. of America, Cambridge, Mass. **(67)**

SPOT WELDING from one side with a portable gun is described in a reprint from a recent magazine article. It is available from Air Reduction Co., Inc., New York, N. Y. The 12 pages give technical data on when and how to use the handy method and describe the equipment. **(68)**

WELDING ELECTRODES made by Air Reduction Co., Inc., New York, N. Y., are described in a booklet entitled "Pocket Guide to Electrodes." Included is Airco's new Easyarc LH7-16 which is said to deposit 60% more metal than conventional low-hydrogen electrodes. **(69)**

HIGH STRENGTH STEEL DESIGN manual is just off the presses says U. S. Steel Corp., Pittsburgh, Pa. The 174-page handbook is available to qualified engineers and architects. It fills the need growing out of the development and widening applications of the low-alloy steels. **(70)**

GRAPHITE LEAD-BASE BABBITT metal, known as "Grac," is described in a 4-page brochure from Graphitized Alloys Corp., New York, N. Y. It is claimed to be a lower cost substitute for high tin-base babbitt. Other advantages are given. **(71)**

DIAMOND DRILL BITS from Diamond Tool Research Co., Inc., New York, N. Y., are described, specified and priced in a condensed 6-page catalog. **(72)**

MINING TOOLS containing tungsten carbide inserts are listed in a 12-page catalog from Vascoloy-Ramet Corp.,

AUGUST 1955

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Please send me the catalogs or further information about the items from New Products Digest whose numbers are circled.

1	15	29	43	57	71	85
2	16	30	44	58	72	86
3	17	31	45	59	73	87
4	18	32	46	60	74	88
5	19	33	47	61	75	89
6	20	34	48	62	76	90
7	21	35	49	63	77	91
8	22	36	50	64	78	92
9	23	37	51	65	79	93
10	24	38	52	66	80	94
11	25	39	53	67	81	95
12	26	40	54	68	82	96
13	27	41	55	69	83	97
14	28	42	56	70	84	98

Name .....

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8	22	36	50	64	78	92
9	23	37	51	65	79	93
10	24	38	52	66	80	94
11	25	39	53	67	81	95
12	26	40	54	68	82	96
13	27	41	55	69	83	97
14	28	42	56	70	84	98

Name .....

Title .....

Company .....

Address .....

E&MJ NEW PRODUCTS DIGEST

Waukegan, Ill. One table shows uses for percussion bits. **(73)**

ELECTRIC SLUSHERS from 10 to 150 hp are cataloged by Vulcan Iron Works Co., Denver, Colo. Shown are tandem styles as well as regular two and three drum single shaft machines. **(74)**

AIR TRAMMERS made by Universal Dredge Mfg. Co., Denver, Colo., are displayed in 4-page brochure. "Cageaire" is a special short compact model a little over 4 ft long. "Tramaster" uses a trailer for air tank. These and the others are said to be low-cost, use less air than a single drill and minimize maintenance. Air motor drives through chain. **(75)**

SCREENING with Sweco Separators, circular vibrating screens, is explained in catalog which gives specifications on models. The 20-page booklet is from Southwestern Engineering Co., Los Angeles, Calif. **(76)**

MILLING LABORATORY MACHINES designed by A. W. Fahrenwald and produced by General Machinery Co., Spokane, Wash., are specified and illustrated in a concise catalog folder. **(77)**

GEAR MANUAL, 76 pages, from Philadelphia Gear Works, Philadelphia, Pa., presents a simplified method of calculating hp ratings as well as illustrating and otherwise covering all types of gears. **(78)**

ELECTRIC CABLE line by Anaconda Wire & Cable Co., New York, N. Y., is dealt with in descriptive catalog. "Securityflex" cord is for especially severe use. Other cords are also listed. Application chart is given. **(79)**

DISPERSIONS, colloidal and semi-colloidal, for operational functions, maintenance, et al., are listed in folder issued by Acheson Colloids Co., Port Huron, Mich. Dry film lubricants and gasket coatings are two of the many applications listed in the chart. **(80)**

ROOF BOLTS is the title of pamphlet announced by Republic Steel Corp., Cleveland, Ohio. Their various bolts and accessories are pictured and discussed. Strongest is the one with forged nut and shell assembly. **(81)**

LIFTING MAGNETS offered by Electric Controller & Mfg. Co., Cleveland, Ohio, are treated in 24-page bulletin. Construction and operating data and application photos are included. **(82)**

JAW CRUSHER, named Rock-Ram, is latest overhead eccentric type developed by Lippmann Engineering Works, Milwaukee, Wis. Bulletin available gives design and operating data. Light weight makes it useful for mobile use. **(83)**

SCREENING fine sizes is the field of application for which Symons V-Screen was designed. Made by Nordberg Manufacturing Co., Milwaukee, Wis., it combines centrifugal and gravitational forces. Descriptive booklet is released. **(84)**

MAGNETIC BRAKE & CLUTCH selection data is included in bulletin showing equipment offered by Stearns Magnetic Inc., Milwaukee, Wis. **(85)**

SHEAVES designed to give variable speeds on belt drives by varying pitch diameter are briefly explained by Allis-Chalmers Manufacturing Co., Milwaukee, Wis., in a folder on "Vari-Pitch" sheaves. Seventy-six percent variation is possible. **(86)**

ELECTRIC MOTOR assembly which uses printed circuit and electron tubes to give adjustable-speed drive from AC power is described in publication from General Electric Co., Schenectady, N. Y. Called "Thy-Mo-Trol" drive, it is compact in size and simple to maintain, says the release. It is for general purpose, ¾ to 3 hp applications. **(87)**

STAINLESS-CLAD STEEL for use in coal handling—hoppers, chutes, pipes, etc.—is publicized in a booklet from Lukens Steel Co., Coatesville, Pa. Long service life and dependable operation is emphasized. It is readily fabricated. **(88)**

RUBBER STORAGE TANKS that are collapsible for easy portability and storage are announced by Goodyear Tire & Rubber Co., Akron, Ohio, in a brochure just published. Bulk liquids can be stored in them as a temporary or emergency measure, in a wide range of applications. Sizes from 900 to 10,000 gal and even special larger ones are available. **(89)**

COOLING CONTROL for maintaining temperature of cooling water in compressors, condensers, etc., is detailed in leaflet from Sarco Co., Inc., New York, N. Y. Shown are typical hookup sketches and engineering data on the self-powered, bellows type "T44" unit. **(90)**

TRANSFORMER bulletin on totally-enclosed dry type, is available from Allis-Chalmers Manufacturing Co., Milwaukee, Wis. High temperature insulation is key design feature of unit which is claimed to be more economical to operate as well as to have lower initial cost than oil-filled one. It is for indoors or out. **(91)**

RECORDING SPECTROPHOTOMETERS come in several models from Beckman Instruments Inc., Fullerton, Calif. Brochure just out details the requirements of various applications and recommends which type to purchase. **(92)**

IGNITACORD

will ignite every fuse in the round

(PLEASE GIVE THIS ADVERTISEMENT TO YOUR BLASTING FOREMAN)

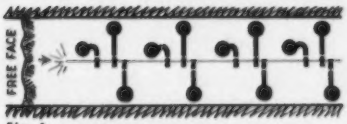


Fig. 1 **FIRING STOPE ROUNDS**

Fig. 1 shows a stope drilled with three rows of uppers, the fuse from each hole being connected to a single line of Ignitacord. Note that the center holes will fire before the two corresponding rib holes.

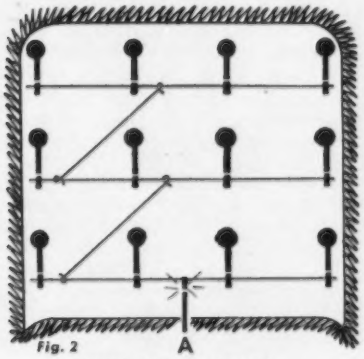


Fig. 2 **FIRING STOPE ROUNDS**

In *Fig. 2* the fuses extending from the horizontal breast holes are connected to four lines of Ignitacord at regularly spaced intervals. Jumper lines connect the horizontal lines, and the Igniter cord is activated by a length of Safety Fuse at Point A.

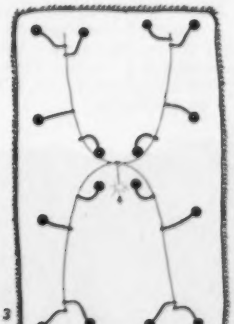


Fig. 3

FIRING DEVELOPMENT ROUNDS

Fig. 3 illustrates an Ignitacord hook-up arranged to fire the cut holes in one group, and the remaining holes in the proper order of rotation. Ignitacord lines should always be kept separated enough to avoid cross ignition.

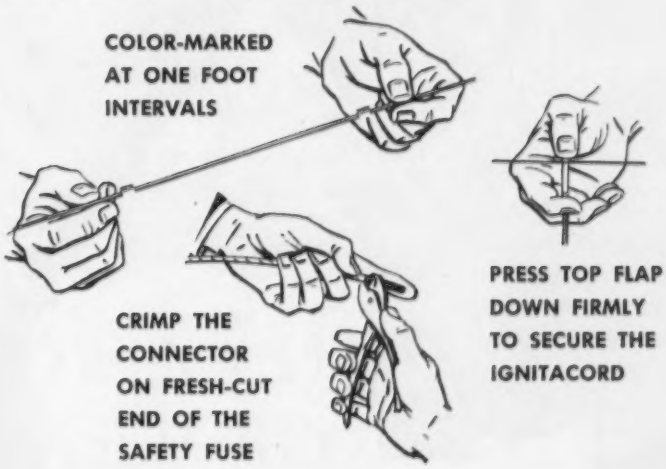
while your Blaster is far, far away!

With Ignitacord* you can have controlled rotation spitting of safety fuse in a round. Here are some of the advantages for you:

Less Hazard. The Blaster lights the Ignitacord at one point. This point can be at the face, if the path of retreat is clear; or at a remote point if the path is difficult, such as when shooting a raise.

Easy Figuring. All fuses in the round are cut to uniform length. There is no need for trimming, since accurate time delay is governed by the length of Ignitacord between holes.

*Sold on the West Coast under the name of SPITTERCORD by the Coast Manufacturing and Supply Co., Livermore, California.


COLOR-MARKED AT ONE FOOT INTERVALS
PRESS TOP FLAP DOWN FIRMLY TO SECURE THE IGNITACORD
CRIMP THE CONNECTOR ON FRESH-CUT END OF THE SAFETY FUSE

Ignitacord burns progressively with a short hot external flame at the zone of burning. Two types are available. Type A burns at the rate of 8 to 10 seconds per foot. Type B burns at the rate of 16 to 20 seconds per foot. Each type is packed on 100-ft. spools.

Ignitacord Connector is a metal shell containing an ignition charge. The shell is crimped on the end of the fuse. Ignitacord is pressed into a slot near the top, and this top is pressed down firmly against it. Connectors are supplied in packages of 100.

See your Explosives Supplier or write to

THE ENSIGN-BICKFORD COMPANY

SIMSBURY, CONNECTICUT

Manufacturers of Primacord® Detonating Fuse, Safety Fuse, Quarrycord, Blasting Accessories — Established 1836

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Address .....

Massive boom built of USS TRI-TEN Steel

helps to keep this giant shovel working around-the-clock all year 'round

This machine is moving an average of well over 1,200,000 cu. yds. of overburden a month at the Wright Mine of the Boonville Collieries Corporation, subsidiary of Ayrshire Collieries Corp. of Indianapolis, Ind.

To pay off on the more than a million-and-a-half dollars invested in this mammoth 45-cu. yd. power shovel it must operate *continuously*—24 hours a day, day after day, every month in the year.

That's why the engineers of the Marion Power Shovel Co., Marion, O., selected USS TRI-TEN Steel for all plates, angles and tees in the massive 120 ft. boom. For this tough, versatile steel not only has great strength—a 50% higher yield point than carbon steel—but in addition possesses an important advantage well proved in other similar construction . . . it has the unusual ability to withstand shock and stress at sub-zero temperatures. Here in short is a true *all-weather* steel.

In other words, when the thermometer drops to the point where a less efficient steel might tend to crack and fail in service, USS TRI-TEN construction can confidently be depended upon to keep the equipment profitably on the job.

Not only in booms like this, but in drag line buckets, heavy-duty truck frames, bull-dozers and power shovels that must be kept working hour after hour in any kind of climate, USS TRI-TEN Steel and its companion, USS TRI-TEN "E" Steel, have proved their superiority by minimizing breakdown hazards. In hundreds of heavy-duty applications, where dependability is of prime importance, the use of these high strength steels has resulted in the kind of uninterrupted operation that spells bigger output at lower cost.

NOW AVAILABLE . . . Our new "Design Manual for High Strength Steels" is ready for distribution. This 174-page book is free. It contains comprehensive and practical information that you will find extremely useful in designing your equipment for greater economy and efficiency by the sound use of high strength steels. For your copy, write on your company letterhead giving your title or department, to United States Steel Corporation, Room 4865, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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USS HIGH STRENGTH STEELS

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USS TRI-TEN • USS COR-TEN • USS MAN-TEN

UNITED STATES STEEL

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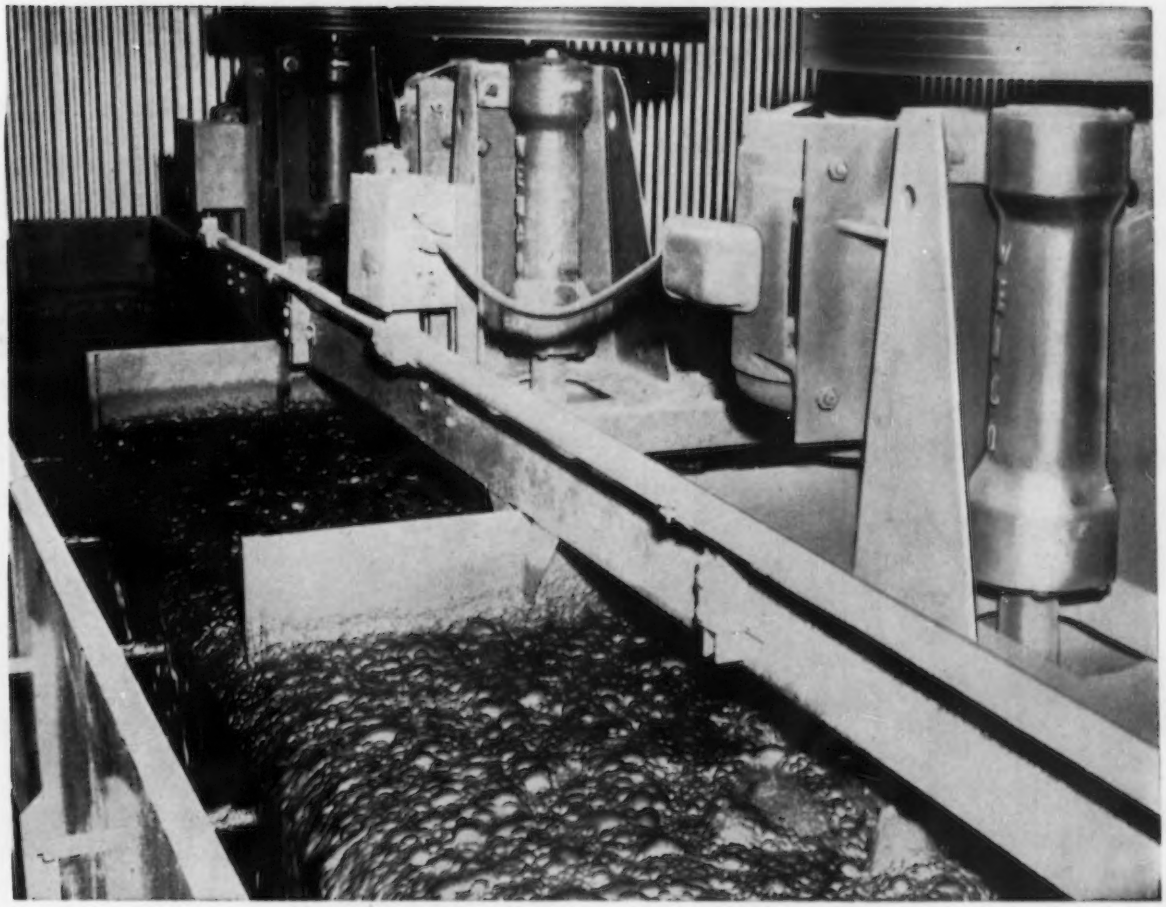

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To fill your need for a quality frother, however, give Dowfroth® 250 a trial. It builds hard-working froth with reduced consumption.

Take advantage of Dow's many years of experience and research. To learn more about the quality flotation agents, Dow Xanthates and Dowfroth 250, write us for information and test samples. THE DOW CHEMICAL COMPANY, Midland, Michigan, Dept. OC-813H-1.

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when you get that "KICK"...

Prove it with a CP Diamond Core Drill

Here's a sure way to get the right information on Uranium deposits. Get a CP-8 or CP-15 Diamond Core Drill. They're built for continuous operation at the high drilling speeds afforded by modern diamond coring bits. Mounted on skids, they can be readily moved from one hole to another under their own power . . . they're also available without skids for truck mounting. The mounting frame is bolted . . . can be quickly knocked down for easy transportation to remote sites. They're available with gas and diesel . . . and with both oil-hydraulic and screw-feed swivel heads. With E-EX Fittings the CP-8 has capacities to 1250 ft., the CP-15 to 2250 ft. Ask for Bulletin 313 for details on Drills and Pumps; and Bulletin 871 for information on Supplies and Operating Equipment.

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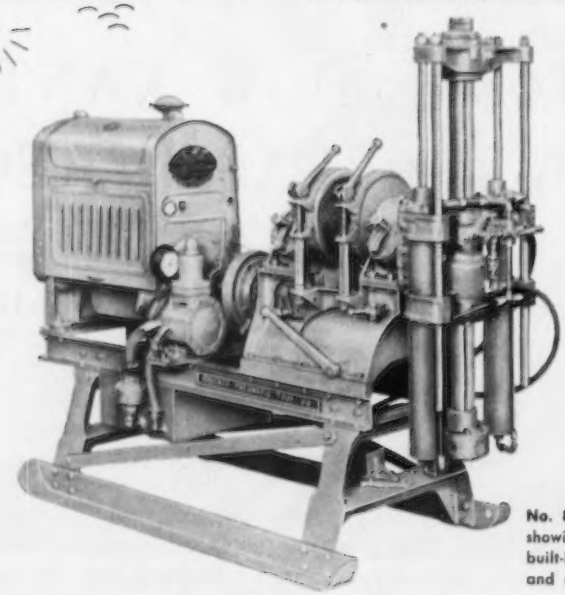
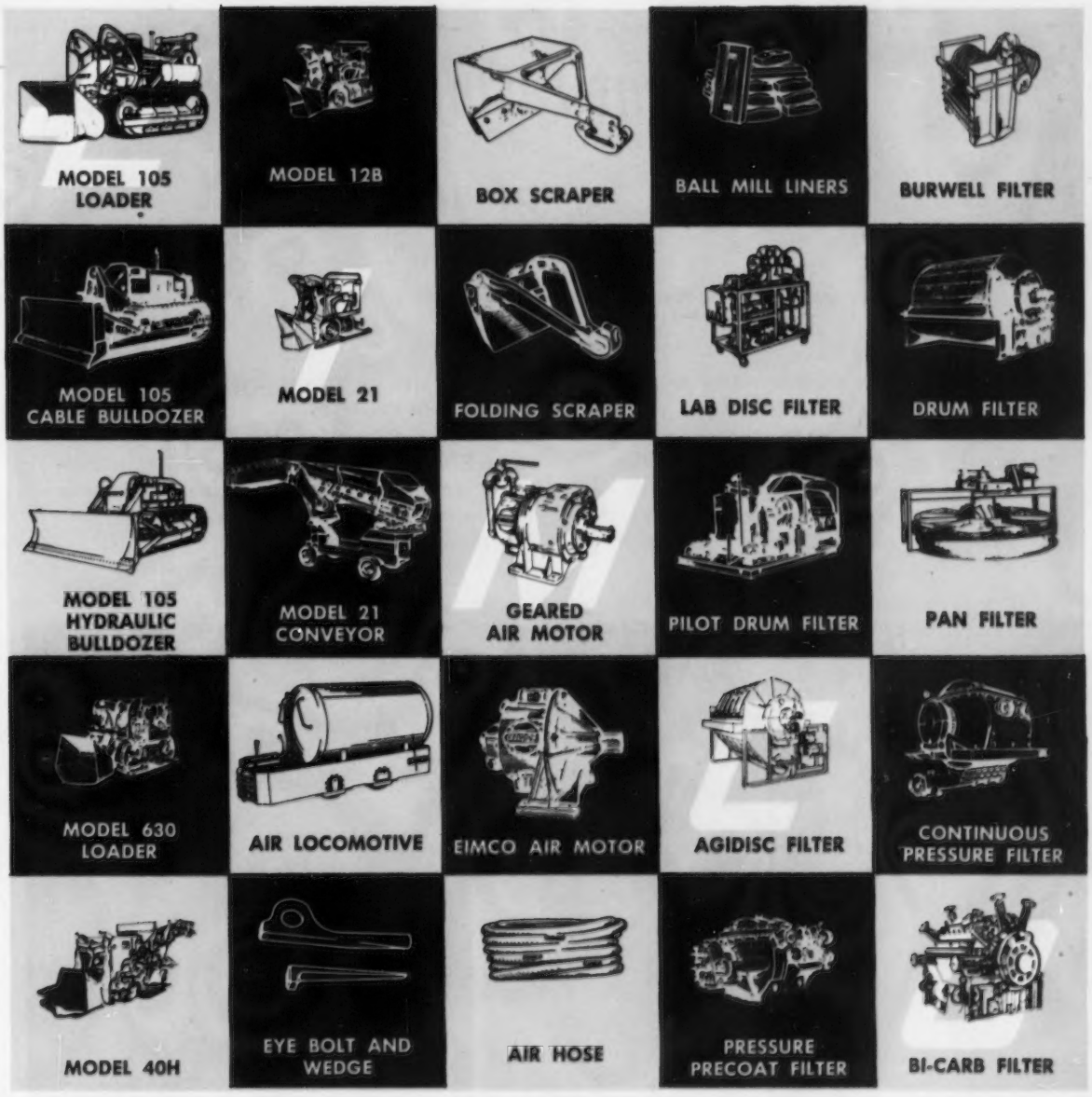
8 East 44th Street, New York 17, N. Y.



No. 8HD GASOLINE DRIVE — showing clutch, hoisting drum, built-in oil hydraulic swivel head and controls.

Chicago Pneumatic

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES



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"Excellent results with Drillube at Iron King"

H. F. Mills, manager, Iron King Mine, Humboldt, Arizona

"We have been getting excellent results with Union's Drillube here at the Iron King Mine.

"For the past 10 years its use has helped to keep stopers, drifters, and jackhammers in top operating condition.

"We have found that Drillube effectively seals abrasive sludge out of the working parts, lessens wear on pistons and chucks, with consequent decrease of air leakage and blowby. We also find but very little fogging of air from oil in the drifts and stopes."

Especially engineered by Union Oil Company for air pressure lubrication, Drillube has proved remarkably successful in mining and quarrying operations throughout the Western United States and Alaska. Your local Union Oil representative can supply you.

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Washed iron ore from concentrating plant is stocked in 42-ft. high piles by Link-Belt 115-ft. radius revolving, self-propelled belt conveyor stacker with 570-ft. long track mounted trailer belt conveyor.

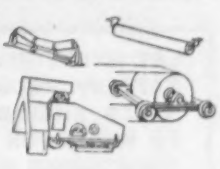
SURE ROAD TO LOWER HANDLING COSTS

... carry the load via Link-Belt belt conveyors

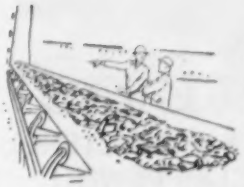
LINK-BELT offers you the "total engineering" so necessary for top efficiency

DESIGNED FOR OVERALL EFFICIENCY—Because of its unrivaled experience, Link-Belt can do a better job of gathering and analyzing all data. Proposals reflect this understanding of the most practical way to fit individual conveyors into your overall system requirements for best results.

BUILT FOR LONG-LIFE PERFORMANCE—Link-Belt manufactures all components and related feeders and conveyors. You are assured of the right equipment because of this breadth of line. And Link-Belt will supply the highest grade belts engineered to the specific job.



DELIVERS FULL RATED CAPACITY—Link-Belt follows through on every detail of the job, including electrical controls and even wiring and foundations. What's more, Link-Belt will furnish experienced erection superintendents, staffs and skilled crews at the customer's request.



ASSURES SATISFACTORY PERFORMANCE—When you rely on Link-Belt as a single source for your complete system, we accept responsibility for placing it in full operating readiness. We will also supervise modernization of existing systems. For all the facts call your nearby Link-Belt sales representative.

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LINK-BELT COMPANY: Executive Offices, 307 N. Michigan Ave., Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

FACTS ABOUT Exide®

IRONCLAD® MINING BATTERIES

FIFTY-TWO CENTS' WORTH OF EXIDE POWER KEEPS A MINE LOCO WORKING FULL-SHIFT!

FOR MORE TRIPS PER SHIFT, MORE PRODUCTION PER MAN-HOUR, POWER YOUR MINE LOCOMOTIVES WITH EXIDES. HAULAGE MOVES FASTER... CAR CHANGES ARE SPEEDED AND LOADERS KEPT BUSY. EXIDES STAY STRONG TO THE END OF THE SHIFT, WITH NO LET-DOWN IN POWER OR PERFORMANCE. RECORDS OF THOUSANDS OF MINES PROVE THAT EXIDE-IRONCLADS COST LESS TO OPERATE, OWN, MAINTAIN. THEY ARE YOUR BEST MOTIVE POWER BUY—

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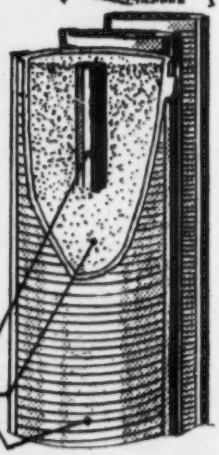
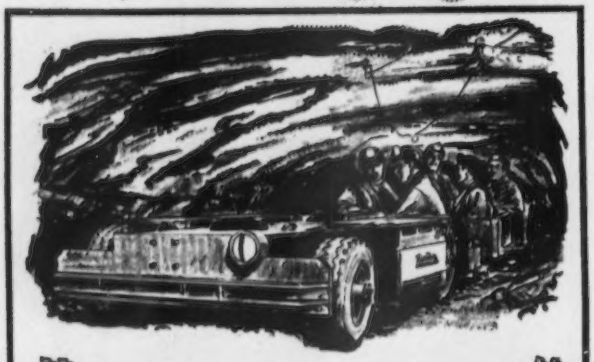
TUBES OF POWER GIVE IRONCLADS LONGER SERVICE LIFE!

FINELY SLOTTED TUBES INSIDE AN IRONCLAD KEEP THE ACTIVE MATERIAL IN FIRM CONTACT WITH THE CONDUCTING GRIDS OF THE POSITIVE PLATE. THUS, THE GRID IS PROTECTED... THE ACTIVE MATERIAL IS KEPT IN CONTACT WITH THE GRID LONGER... *THE BATTERY'S WORK LIFE IS LENGTHENED.* THE SLOTTED TUBES ALSO EXPOSE MORE ACTIVE MATERIAL TO THE ELECTROLYTE... *FOR GREATER POWER!* RESULT: THE IRONCLAD'S ABILITY TO DO A DEPENDABLE JOB FOR A LONGER PERIOD OF TIME.



PROTECTED SILVIUM CONDUCTING GRID
COMPRESSED ACTIVE MATERIAL
SLOTTED POLYETHYLENE RETAINER TUBE



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CUTS COSTS, BOOSTS PRODUCTION WITH EXIDE-IRONCLAD POWER!

THIS EXIDE-POWERED TRACTOR-TRAILER SPEEDS WORK CREWS, SUPPLIES AND EQUIPMENT TO PRODUCTION AREAS IN HALF THE TIME OF OTHER METHODS—WITH SAFETY, AND AT LOWEST COST. TO CUT PORTAL-TO-PORTAL TRAVEL TIME OR BOOST PRODUCTION, LET EXIDES HELP YOU. YOU'LL DO IT FASTER, BETTER, CHEAPER!

LET EXIDE HELP SOLVE YOUR MINING BATTERY PROBLEMS. ❶ CALL AN EXIDE SALES ENGINEER FOR FULL DETAILS. ❷ WRITE FOR FORM 1982, A MANUAL ON MAINTAINING MOTIVE POWER BATTERIES.

Exide INDUSTRIAL DIVISION, The Electric Storage Battery Company, Philadelphia 2, Pa.

WHAT IS A WICKWIRE ROPE DISTRIBUTOR?

- He's quality people... handling quality products.
- He knows the local industries he serves, and he knows wire rope.
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- He brings you Wickwire Rope and Slings at the lowest possible cost, because he spreads his sales and distribution expense over the hundreds of related items he carries.
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3 NEW "TOOLS"

for Effective Dust Control

1 AMERclone Dry Centrifugal Collector designed to handle large exhaust volumes containing dry, granular dust in large concentrations. Strictly a product of AAF research, AMERclone offers many features new to dry centrifugal design that result in these important advantages—

High Collection Efficiency. AMERclone offers collection efficiencies equal to or better than any centrifugal unit available today.

Requires Less Space. The fact that a single AMERclone tube, 4" in diameter, has a cleaning capacity of 333 cfm as compared to a 100 to 150 cfm rating for conventional units makes for important space savings.

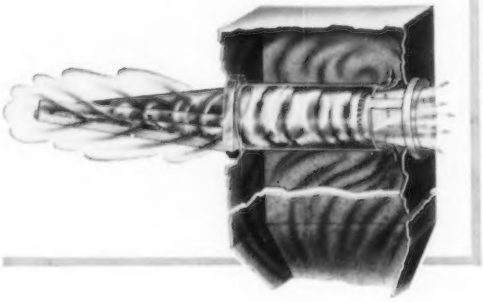
Less Subject to Abrasion. Abrasion resistance qualities are greatly increased with the use of thick wall gray iron castings, plus the fact that in AMERclone operation there is no recirculation of dust load to increase abrasive effect.

Maintains Efficiency. Collection efficiency of the AMERclone remains practically constant over a wide range of exhaust volumes with the compensating feature of the secondary air circuit.

For complete AMERclone data, write for AAF Bulletin No. 291.

AMERclone

DRY CENTRIFUGAL COLLECTOR



AMERjet

FABRIC ARRESTER

2 AMERjet Fabric Arrester designed to handle extremely fine particles or collect material dry for reclaiming. Like all AAF Dust Control Products, AMERjet offers these basic features: **(1) small space requirements; (2) maintained performance over a wide range of operating conditions; (3) constant exhaust volume; (4) high collection efficiency.**

For complete AMERjet data, write for Bulletin No. 279.

3 Design 4 Type N ROTO-CLONE Hydro-Static Collector —A new version of AAF's famous Hydro-static precipitator which, in addition to the proven high efficiency cleaning action of its inverted S-shape water curtain, now offers—

- Improved and simplified entrainment separators to further reduce unit's low maintenance costs.
- Addition of 4 larger sizes to permit handling of exhaust volumes up to 50,000 cfm.
- Improved water level control maintains performance under extremes in operating conditions.

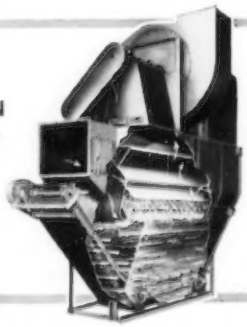
For complete Type N data, write us for AAF Bulletin No. 277.

DESIGN 4 TYPE N

ROTO-CLONE

HYDRO-STATIC

COLLECTOR



AAF

American Air Filter

COMPANY, INC.

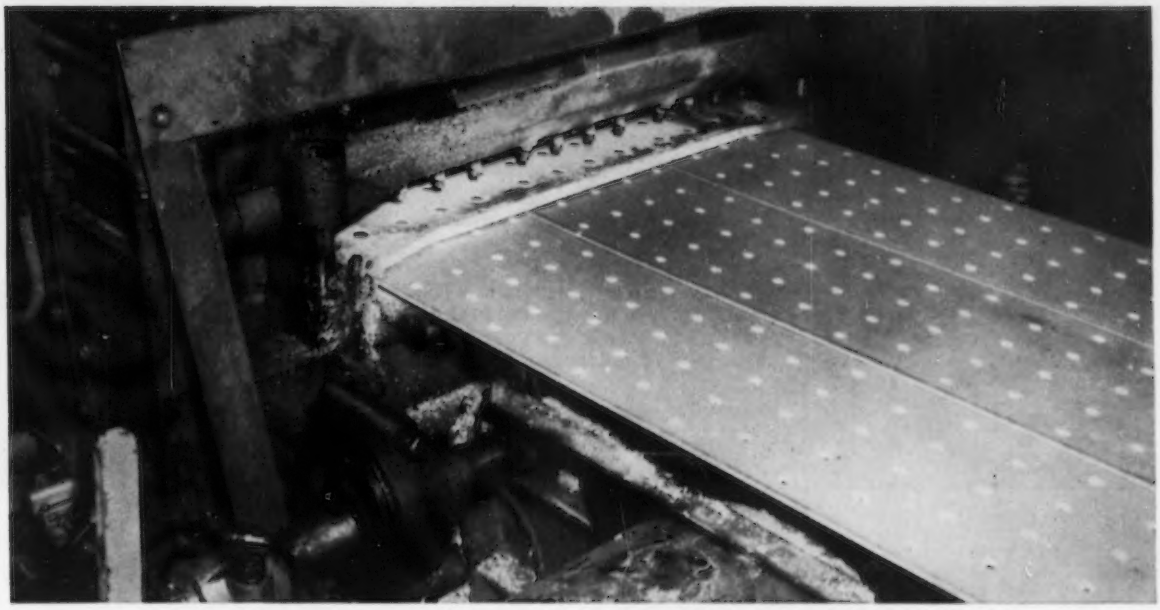
American Air Filter of Canada, Ltd., Montreal, P. Q. • 193 Central Avenue, Louisville 8, Kentucky

Standard Engineer's Field Report

CASE HISTORY
Calol Gear Compound
LUBRICANT

Blue Diamond Corp.,
FIRM Blue Diamond, Nevada

Wet punch works 5½ years without gear loss despite extreme pressures and shock loads



BLUE DIAMOND CORPORATION, a leading Western gypsum producer, has rolled gypsum lath through this Ehrsam wet punch press 24 hours a day for 5½ years without a gear loss. Shock loads on this 500-pound punch exert extreme pressure on gear teeth, yet Calol Gear Compound keeps them in perfect condition. Even under these severe load conditions the lubricant protects teeth surfaces against galling and scuffing. Calol Gear Compound is available in eight grades to meet specifications of various gear manufacturers.

FREE CATALOG: "How To Save Money On Equipment Operation," will be sent on request to Standard Oil Company of California, 225 Bush St., San Francisco.

FOR MORE INFORMATION about this or other petroleum products of any kind, or the name of your distributor, write or call any of the companies listed below.

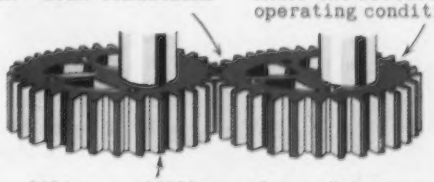
CALOL

TRADEMARK "CALOL" REG. U. S. PAT. OFF.

Why CALOL GEAR COMPOUND protects enclosed gears

Tough film protects gear teeth against scuffing and scoring under severe shock—load conditions

Highly adhesive... clings to gear teeth and bearings, even under the wettest operating conditions

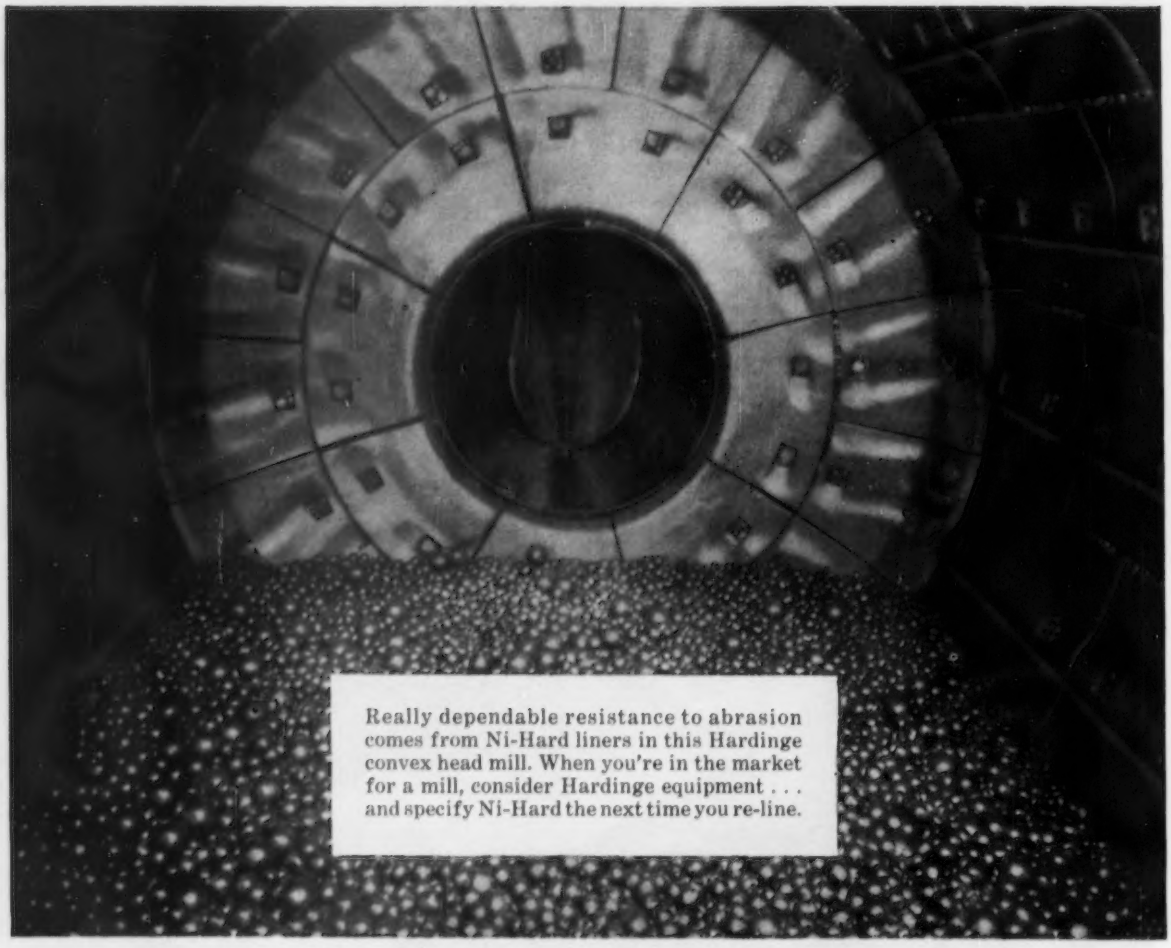


Oiliness additive reduces friction

STANDARD OIL COMPANY OF CALIFORNIA, 225 Bush Street • San Francisco 20, California

THE CALIFORNIA COMPANY P. O. Box 780 • Denver 1, Colorado

STANDARD OIL COMPANY OF TEXAS P. O. Box 862 • El Paso, Texas



Really dependable resistance to abrasion comes from Ni-Hard liners in this Hardinge convex head mill. When you're in the market for a mill, consider Hardinge equipment . . . and specify Ni-Hard the next time you re-line.

Hardinge Installs NI-HARD

...to extend liner life in their mills

Hardinge Company, Inc., of York, Pennsylvania, well-known producer of scrubbers, classifiers, cylindrical tube and batch mills, rod mills and other milling equipment, knows that satisfied customers mean more business. That's why Hardinge installs Ni-Hard liners as original equipment in their mills.

Ni-Hard liners actually double and triple the interval between relinings because they provide maximum resistance to abrasive wear. This resistance helps Ni-Hard liners maintain their contours and so mill more tons of ore per pound of wear.

Tougher than its hardness indicates

Ni-Hard shows greater strength and resistance to both impact and wear than does unalloyed white cast iron. So try Ni-Hard liners in your own mills . . . prove to yourself they can save you money.

Get the facts about Ni-Hard. Write us today.

INCO **THE INTERNATIONAL NICKEL COMPANY, INC.** 67 Wall Street New York 5, N.Y.

CF&I ROCK BOLTS

make mine roofs and walls *SELF-SUPPORTING*

Conventional mine timbering is as old-fashioned as it is cumbersome, dangerous and expensive.

With CF&I Rock Bolts, there's no need for bulky timbers that require added transportation and installation, that restrict the efficient operation of machinery and limit miners' output. CF&I Rock Bolts are simply anchored in mine roofs and walls, and give secure support.

CF&I Rock Bolts offer these advantages:

- **Reduce danger of roof falls due to blast effect**
- **Provide valuable additional working space**
- **Afford better ventilation**
- **Are less bulky to store and haul**
- **Low-cost installation**

SLOT & WEDGE TYPE

EXPANSION SHELL TYPE

CF&I Rock Bolts are available in slot and wedge type and expansion shell type with Pattin shell.

Learn how CF&I Rock Bolts can improve your own operations. Write today for descriptive information.

3185

CF&I ROCK BOLTS

THE COLORADO FUEL AND IRON CORPORATION

CF&I STEEL PRODUCTS FOR THE MINING INDUSTRY

Grinding Balls • Grinding Rods • Wickwire Rope • Mine Rails and Accessories • Cal-Wic Industrial Screens

ANOTHER COMPLETELY NEW
PAYLOADER®
Biggest Yardage Producer In Its Class

COMPLETE Power-Shift Transmission

Makes ALL Shifts WITHOUT Stopping!

This "PAYLOADER" has a newly-developed power-shift transmission which is the easiest-operating, fastest-acting, most efficient ever put into a tractor-shovel. Shifting from *any* speed range to *any* other is accomplished instantaneously by fingertip action — *on the go* — there's no stopping, no "clutching". Directional shift (forward and reverse) is just as easy and just as fast. All speed ranges are provided in reverse as well as forward. Also included is a highly-efficient polyphase torque-converter that matches engine speed and torque to the load *instantly* and multiplies the engine torque up to 350%.

• with more digging power
• with faster operating cycles
• with easier, safer operation

YOU'VE never seen anything like this big new "PAYLOADER" — because there *is* nothing else like it. Nothing else like it in design — nothing like it in performance.

No other tractor-shovel gives you the tremendous digging power; the ability to get and keep heaped bucket loads under all conditions; the *complete* power-shift transmission which speeds operating cycles; the balance and stability to handle big loads fast, safe and easy.

If you want big, steady output — dependable performance hour after hour, put this husky HO on your jobs and you'll see the difference. Stop in at your nearest "PAYLOADER" Distributor and look it over.

HOUGH-DESIGN HOUGH-QUALITY

Safety and Stability. Special boom-arm shape and positioning keeps moving members out of operator's reach at all positions. Close, low, load-carry position and longer wheelbase provide stability and balance for fast maneuvering — with safety.

More Horsepower per bucket capacity than other standard models. Either gasoline or diesel power available.

Easy to Operate. Fullest operator visibility for safe, fast maneuvering; power steering; power-shift — no "clutching"; 4-wheel hydraulic brakes — vacuum boosted; foam rubber molded seat and back cushions; seat adjustable for operator comfort; longer wheelbase adds to rider comfort.

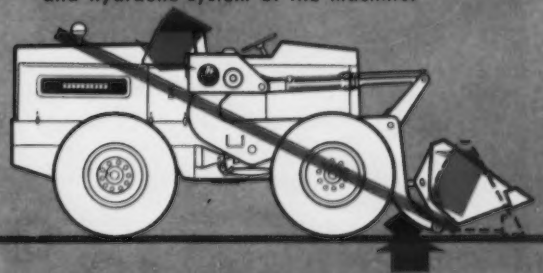
Superior Hydraulic System. Sealed, pressure-controlled hydraulic system to keep dirt and air out of oil; double-acting, long-life hydraulic rams with chrome-plated piston rods, and highest quality oil lines and fittings.

Fully-Equipped. Standard equipment includes: built-in headlights, back-up lights and tail lights; 12 volt electrical system for gas-powered units.

Extra Equipment for Greater Usefulness. Bulldozer blade, special buckets, bucket teeth, crane hook and lift fork attachments; snow plows, backhoes and many other useful and special accessories will be available.

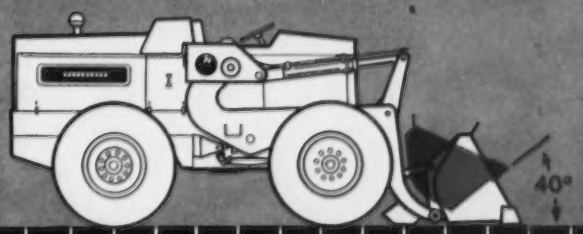
POWERFUL PRY-OUT ACTION

Tremendous pry-out force is obtained by using the breakout pads on the ground as a fulcrum for leverage. The load forces opposing the pry-out action are thus transferred to the ground through the pads instead of to the axle, wheels and hydraulic system of the machine.



40° BREAK-OUT AT GROUND LEVEL

You can get HEAPED BUCKET LOADS and you get them FASTER and EASIER WITH THIS NEW BUCKET ACTION. Most important of all — you KEEP BIGGER PAYLOADS — because the bucket can be tipped back a full 40 degrees at ground level before it is raised, eliminating spillage.



PAYLOADER®
MANUFACTURED BY
THE FRANK G. HOUGH CO. LIBERTYVILLE, ILL.
SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

THE FRANK G. HOUGH CO.
726 Sunnyside Ave., Libertyville, Ill.

Send full information on the new Model HO, 2-cu. yd. "PAYLOADER"

NAME .....

TITLE .....

COMPANY .....

STREET .....

CITY .....

STATE .....

Using stoper, new hole is started at The New Jersey Zinc Co.'s Sterling Mine. Bethlehem Hollow is providing excellent service.

Drilling Stubborn Ore in Northern New Jersey

Operating nearly a half-mile beneath the surface in the Sterling Mine of The New Jersey Zinc Co., at Ogdensburg, N. J., drilling crews are continually faced with formidable opposition: medium-hard limestone, plus concentrations of willemite, zincite, and franklinite.

To dislodge the ore and mineral deposits as quickly and economically as possible, the crews are using jackhammers, stopers and drifters, equipped mainly with Bethlehem Hollow Drill Steel, and fitted with either multi-use or carbide-insert bits. The Bethlehem Hollow, in 1¼-in. rounds, ⅞-in. hexagons, and ⅞-in. quarter-octagons, makes blast-hole patterns up to 15 ft deep. It's giving a good account of itself, too. Reconditioning is done at The New Jersey Zinc Co.'s modern shop at the mine site.

Bethlehem Hollow Drill Steel is ideal for all types of difficult mine applications because it is rolled from a tough, fatigue-resisting steel. Its wide quenching range makes it easy to heat-treat for the proper balance of hardness and wear-resistance. It also makes possible long-wearing threads and tough shanks.

Bethlehem Hollow Drill Steel comes in rounds, hexagons and quarter octagons, and is usually supplied in lengths of from 18 to 25 ft. Longer lengths can be furnished for special requirements. For top performance, choose Bethlehem Hollow for your drilling program.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM HOLLOW DRILL STEEL

AIR AT WORK

New two-stage Ro-Flo compressor provides constant efficiency... cuts maintenance

Efficiency and air supply are constant year after year with *Ro-Flo* compressors. Even if wear occurs, it is automatically compensated for, so that air supply is unaffected.

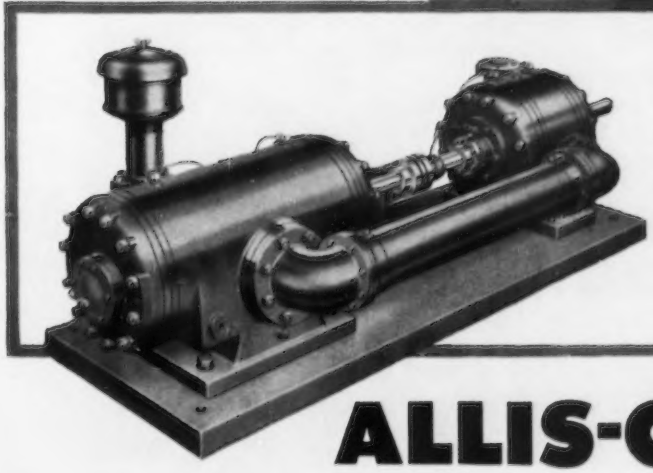
In addition, rotary design eliminates practically all vibration. No heavy foundations are needed.

Maintenance is cut too! There is no wear and tear from shock and vibration . . . no hard-to-maintain pistons and valves.

For constant efficiency . . . overall savings on air, modernize air supply with two-stage *Ro-Flo* compressors.

GET THE FACTS: Contact your A-C office or write Allis-Chalmers, Milwaukee 1, Wis.

Ro-Flo is an Allis-Chalmers trademark.



Two-stage *Ro-Flo* compressors in pressures from 60 to 125 pounds gauge, and volumes from 250 to 1800 cubic feet per minute. Single-stage units for lower pressures.

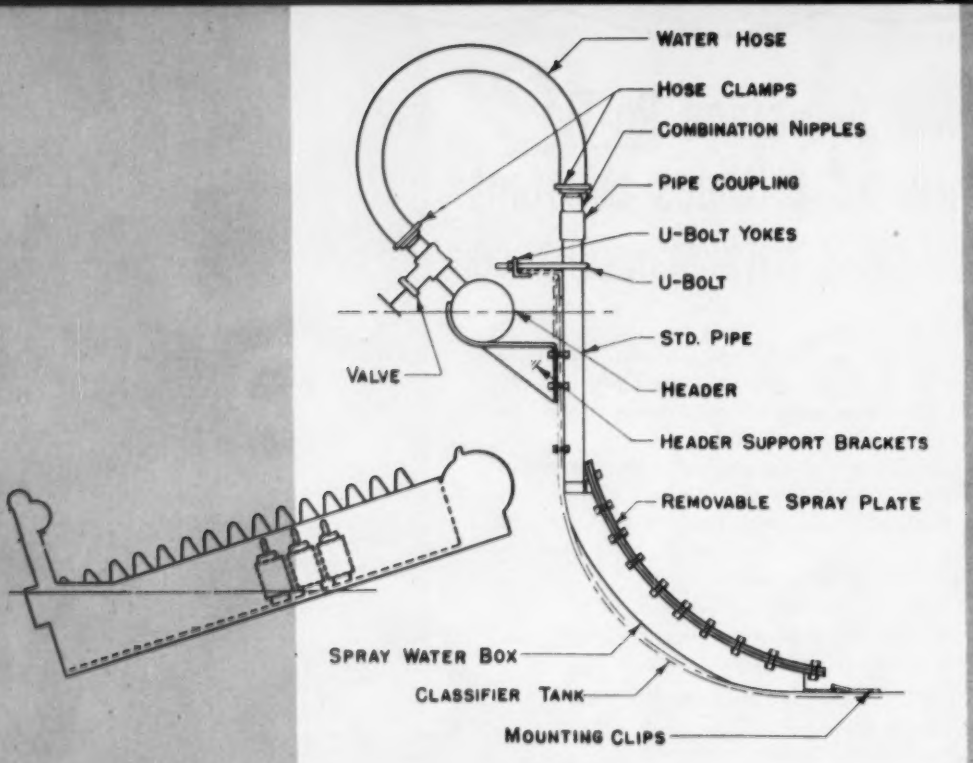
A-C ALLIS CHALMERS

A 4738

ALLIS-CHALMERS

spray water box attachment on AKINS Classifier

solves difficult sand-washing problems



The Akins Spray Water Box was developed by Colorado Iron Works Co. in 1937 and has proved to be particularly valuable in cases where adhesion of slime particles to sand is so persistent that a clean separation cannot be made by normal classification.

Spray Water Boxes, generally furnished in multiple assemblies, are easily and quickly bolted to the standard Akins Classifiers and are placed at the lower end of the drainage deck. The top spray plate is gasketed and bolted for quick, easy removal and replacement when spray holes are blinded.

COLORADO IRON WORKS CO.

1624 17th Street • Denver 2, Colorado

AKINS CLASSIFIERS • SKINNER ROASTERS • LOWDEN DRYERS

A SUBSIDIARY OF THE MINE & SMELTER SUPPLY CO.

Cyanamid REAGENT NEWS

"ore-dressing ideas you can use"

AEROMINE® 2026 *Cationic Promoter Now Available*

Tested, proven and now regularly used at Cyanamid's own Florida phosphate operations, AEROMINE 2026 is now available to other users of cationic promoters.

Product of several years intensive research, AEROMINE 2026 is used at several Florida phosphate plants for removing silica. A bulk concentrate comprising phosphate rock and silica is made by flotation with a crude fatty acid collector, (such as AERO* Promoter 708). Concentrates are then washed with a dilute sulfuric acid solution to destroy the fatty acid collector coating the mineral particles. Finally, the silica is floated off with the cationic collector, AEROMINE 2026 Promoter, leaving behind a high-grade phosphate rock product.

AEROMINE 2026 has also shown promise on non-metallic operations making a separation of feldspar and silica. Used in a hydrofluoric acid circuit, it selectively floats feldspar away from quartz.

AEROMINE 2026 is a dark brown paste with an ammoniacal odor. Like other cationic collectors it has some frothing properties. It can be fed as a 5 to 10% solution in water, kerosene, alcohol or a frother.

We will be glad to furnish samples of this reagent for laboratory evaluation and to discuss its use with you. A post card or letter to our office in New York will bring a prompt reply.

*Trade-Mark

AMERICAN Cyanamid COMPANY

MINERAL DRESSING DEPARTMENT

30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.

Cable Address — Limenitro, New York

NORTH AMERICAN CYANAMID LIMITED
Royal Bank Bldg., Toronto 1, Ontario, Canada
CYANAMID DE MEXICO, S. A.,
Apartado No. 26012, Mexico 12, D. F., Mexico

CYANAMID PRODUCTS, LTD., Bush House,
Aldwych, London W. C. 2, England
SOUTH AFRICAN CYANAMID (PTY.) LTD.,
P. O. Box 7552, Johannesburg, Union of South Africa

E. P. CADWELL, Casilla 12983,
Correo 11, Santiago, Chile
G. B. O'MALLEY, MALCOLM GLEN,
377 Little Collins St., Melbourne C. 1, Australia

Printed in U. S. A.

Looking for millionths of an inch to keep your Crane Valves tighter longer

How big is a micro-inch?

At Crane it's *mighty big* . . . because it is one of the noticeable differences between Crane Quality Valves and the run-of-the-bin kind.

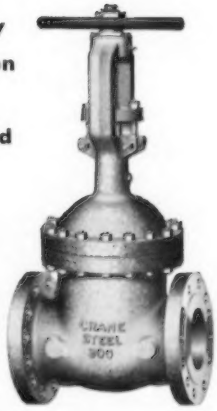
Measuring seating surface smoothness in micro-inches is the job of the Crane technician in the picture. His findings are important to keeping Crane production at the high-quality level.

Crane carefully measures seating surface smoothness to make sure that the Crane Valves you install will operate smoothly without seizure, seat tightly and wear longer, thus helping reduce your maintenance and repair costs to the minimum.

Such care in manufacture for more than 100 years is just *one* reason why thrifty buyers prefer Crane Valves . . . why industry keeps on using more Crane Valves than any other make . . . why you should always buy Crane.

Crane Co., General offices: 836 S. Michigan Ave., Chicago 5, Ill. Branches and Wholesalers Serving All Industrial Areas.

Better Quality
Bigger Selection
in Valves
for Every Need



CRANE CO.

VALVES · FITTINGS · PIPE
KITCHENS · PLUMBING · HEATING

CRANE'S FIRST CENTURY...1855-1955

Apartado No. 26012, Mexico 12, D. F., Mexico
P. O. Box 7552, Johannesburg, Union of South Africa
377 Little Collins St., Melbourne C. 1, Australia
Printed in U. S. A.

GM DIESEL
CASE HISTORY No. IA3-15

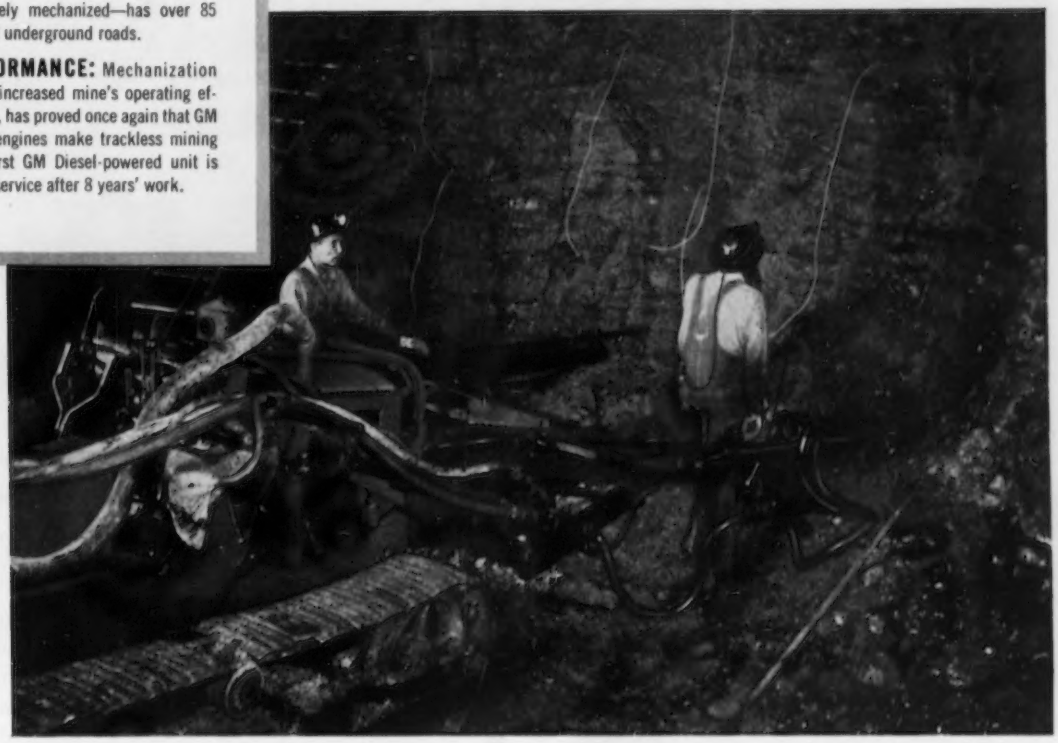
OWNER: Eagle-Picher Company, Miami, Oklahoma.

INSTALLATION: 50 GM Diesel-powered ore haulers, shovels, drills and personnel cars in zinc mine. Mine is completely mechanized—has over 85 miles of underground roads.

PERFORMANCE: Mechanization greatly increased mine's operating efficiency, has proved once again that GM Diesel engines make trackless mining pay. First GM Diesel-powered unit is still in service after 8 years' work.

8 years underground

and still going strong



TO A General Motors 2-cycle Diesel engine "home" is where the job is. That's why you'll find both underground and surface (strip) miners specifying GM Diesel power for their mines.

In the Eagle-Picher underground mine, GM Diesel engines equipped with exhaust scrubbers keep production on the move.

And in both deep mines and strip mines GM Diesels help move more tons at less cost. Their 2-cycle operation with power at every piston downstroke means faster acceleration, less time spent per haul trip or bucket swing. What's more, you can run a GM Diesel for a lifetime because all parts and components are easily replaced.

Eagle-Picher executives say the local GM Diesel distributor was "invaluable" in working out some of their power problems. Back of the low-cost performance of GM Diesels *everywhere* stands a network of distributors ready to give you service and fast delivery of low-cost parts. These GM Diesel distributors are power experts. Call the one nearest you today for details on GM Diesel power for your mine.

DETROIT DIESEL ENGINE DIVISION
GENERAL MOTORS • DETROIT 28, MICHIGAN
Single Engines . . . 30 to 300 H. P. Multiple Units . . . Up to 893 H. P.

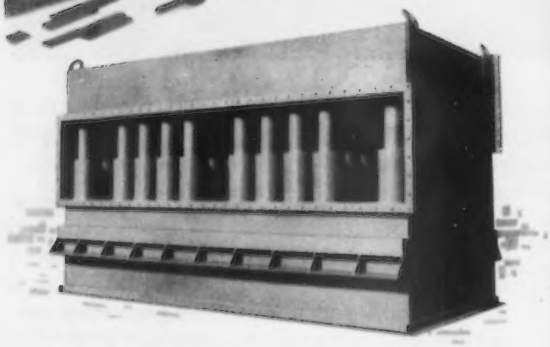
VISIT GENERAL MOTORS POWERAMA Gala Celebration of 100 Million GM Diesel Horsepower—Lake Shore South, Chicago—Aug. 31st through Sept. 25th

Turning DUST into DOLLARS

...created a job for WHIRLEX in one of the world's largest iron ore mining operations

21 WHIRLEX collector and Fan units... 21 CARLOADS

Taconite dust is very abrasive and is recognized in the mining industry as being one of the roughest of materials on process equipment. The selection of "WHIRLEX" Collectors and Fans supplied for this application resulted from a rigid field test of full sized pilot equipment, over a period of several months. The pilot operation definitely proved that the equipment consistently performed with high collection efficiency under extreme variable conditions, and also was rugged enough to withstand the severe erosive effects of heavy concentrations of Taconite dust.



The Type MTSA-9CY18S Multiple Cyclone Collector is especially designed to operate at high collection efficiency with excessive dust loads. Extra heavy, all welded, steel elements and casings insure a long service life with minimum maintenance requirements. The open type construction employed provides convenient access to all working parts.

Inquiries on special dust problems are solicited. Descriptive literature will be furnished on request.

FLY ASH ARRESTOR CORP.

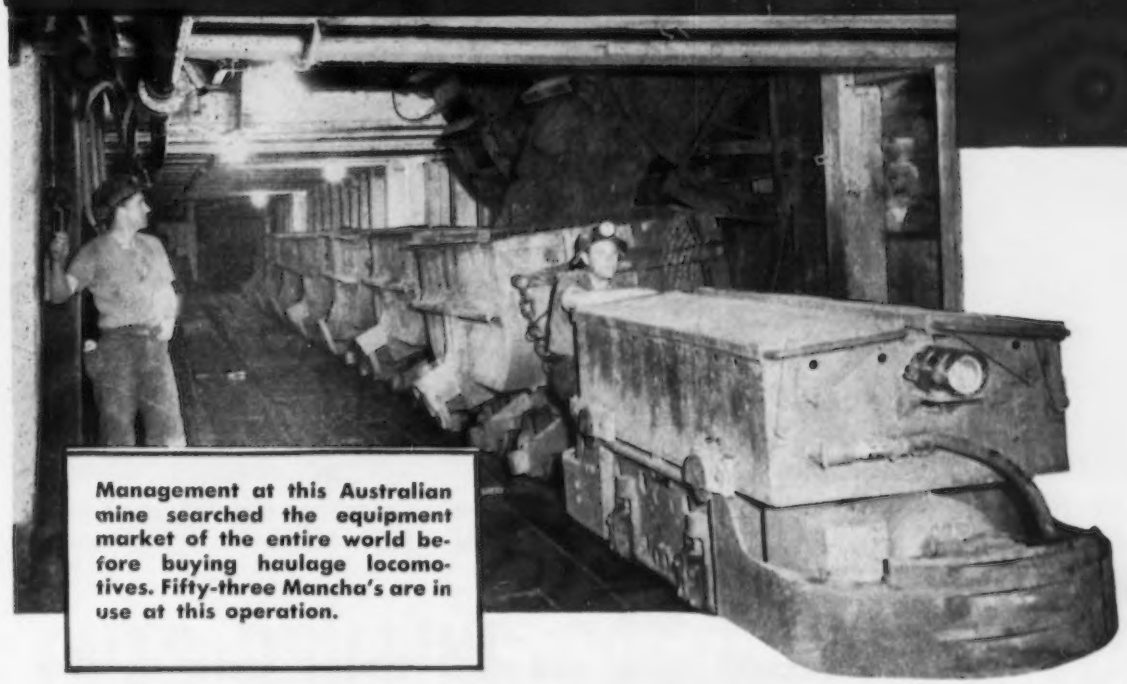
Birmingham, Alabama

227 N. FIRST STREET TELEPHONE 54-6676

Search the world for the most efficient haulage locomotive

You'll choose MANCHA!

Storage Battery Locomotives proved for stamina, safety, and economy



Management at this Australian mine searched the equipment market of the entire world before buying haulage locomotives. Fifty-three Mancha's are in use at this operation.

MANCHA BUILDS THEM BIG...STRONG...WILLING!

- Mancha locomotives are built to haul a train of big cars all day long.
- Chassis design provides extraordinary strength, yet carefully limits weight so as to give every Mancha locomotive *extra battery capacity.*
- Battery energy is used *productively,* in moving muck, not wasted moving an unnecessarily heavy locomotive chassis.
- Antifriction bearings support all moving parts—hold frictional losses to a minimum.

Revamping your mine transportation system? Mancha offers the locomotives you need for your particular mine conditions. We invite you to take advantage of our thirty-five years of experience gained in the manufacture and application of mine locomotives.

Mancha Storage Battery Locomotive
Division **GOODMAN** *Manufacturing Company*
4850 South Halsted Street, Chicago 9, Ill., U.S.A.

EMJ 855

Tell me more about Mancha locomotives.

NAME _____

FIRM _____

ADDRESS _____

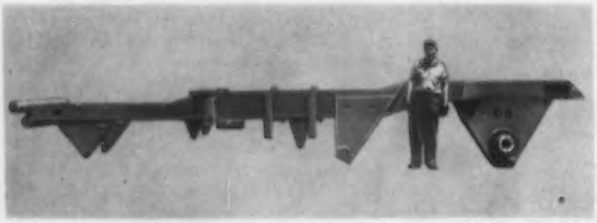
CITY _____ ZONE _____ STATE _____

MANCHA STORAGE BATTERY LOCOMOTIVE
Division **GOODMAN** *Manufacturing Company*
4850 SOUTH HALSTED STREET CHICAGO 9, ILL., U. S. A.

DART MODEL 40T, one of five 40-tonners recently added to a fleet of DARTS in service at one of the large ore mines.

15 DARTS

haul ore at 40 tons per cycle on a strong backbone...



THE FAMOUS DART "BACKBONE"

The DART box girder frame is welded into box section by submerged arc welding. Gusset supported crossmembers are welded integral with the frame for great rigidity. Two, 6-inch pipe bumpers offer front-end protection. Front and rear two clevis and torque arm brackets are integral parts.

The DART box girder frame has earned its reputation by successful service under the most rigorous conditions.

DART ENGINEERS CAN HELP SOLVE YOUR HAULAGE PROBLEM...YOUR INQUIRIES ARE INVITED

D-111

In huge mining operations all over the world, DART TRUCKS are known for their availability and economical operation. Recent additions of new DARTS to existing DART fleets in many well known mines are solid testimonials of DART leadership in mine haulage.

The 40T with its DART-designed-and-built 140,000 lb. capacity tandem axle is a mine "workhorse"... its powerful diesel engine with Twin Disc 3-stage torque converter (with automatic down-hill braking feature) and Fuller 4-speed transmission give it performance and maneuverability that is surprising for a truck of its size. Twin telescopic hoists, oversize air brakes, hydraulic steering and 73-inch mining cab add greatly to driver comfort and safety.

DART TONNAGE ENGINEERED TRUCKS

Kansas City 8, Missouri

SUBSIDIARY OF THE CARLISLE CORPORATION

..JOY DRILL JIB/TRACTOR COMBO

CUTS DRILLING COSTS 56¢ A TON!

A uranium mining company made their own Drillmobile by mounting two Joy LM-67 Drills with 6′ chain feeds and Hydro Drill Jibs on a diesel tractor. Result was an 80% reduction in labor costs!

This "Jib-Tractor" drills two faces a shift. Each face consists of 120 to 130 holes, is 18′ wide, 18′ to 20′ high. The Joy extendable Jibs drill horizontal holes up to the 18′ height and slanted holes at 20′.

Drilling speed in sandstone ranged from 30″ to 36″ per minute. Average footage drilled and broken is 7 feet. Ground broken per round is about 150 tons. Previously, air legs and stopers were used for drilling. The table at right illustrates the saving in drilling costs with this new "Jib-Tractor."

Write for Bulletin 87-F to ***Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

FORMATION	Sandstone
DRIFT SECTION	18′ x 20′
HOLES PER FACE	120 to 130

	Jib-Tractor	Air Legs & Stopers
Rounds drilled per shift	2	½
Tons broken per shift	300	85
Labor cost per shift	$40	$60
Labor cost per ton	14c	70c
Saving per ton	56c	—

Consult a Joy Engineer

for AIR COMPRESSORS, ROCK DRILLS, HOISTS AND SLUSHERS

W&D M 5505

JOY

WORLD'S LARGEST MANUFACTURER OF UNDERGROUND MINING EQUIPMENT

Cut Downtime. . . .

on the St. Lawrence Seaway

INITIAL excavation for the Long Sault Dam on the St. Lawrence Seaway is right on schedule. On this project, as on all the excavation projects of the St. Lawrence Seaway, Firestone Nylon Tires are eliminating big downtime losses, giving more retreads and keeping tire costs at a minimum.

You can cut your costs with Firestone Nylon Tires because they are specifically engineered for the job. The treads give more traction and they are extra tough to resist cutting. Double-thick sidewalls give added protection against cuts and snags.

The new Firestone Safety-Tensioned Gum-Dipped* nylon cord body insures longer tire life and more retreads. The Firestone SafetyTensioned Gum-Dipped* nylon body gives the greatest protection against impact breaks . . . flex breaks . . .heat failures . . . and water damage.

Let your Firestone Dealer or Store show you how Firestone Nylon Off-The-Highway Tires will cut your downtime and increase your profits.

*Trade Mark Reg. U.S. Pat. Off.

A TIRE FOR EVERY ROAD, LOAD AND CONDITION OF SERVICE

GROUND GRIP • ROCK GRIP • GG WIDE BASE • ALL NON-SKID • ALL TRACTION • RIB EXCAVATOR

When you buy new equipment or replacement tires, specify Firestone

Enjoy the Voice of Firestone on radio or television every Monday evening over ABC

Copyright 1955, The Firestone Tire & Rubber Co.

Longyear

Our new Wire Line Core Barrel on display in Paris for the Societe de L'Industrie Minerale

Position of core barrel at end of core run

Inner Tube with core is pulled up from hole

String of drill rods and outer tube remain in hole

Another inner tube dropped and drilling resumed -- immediately!

1. Retrieving inner tube takes only a fraction of the time needed for retrieving a string of drill rods.
2. Increases net drilling time, more footage per shift.
3. Less caving in the hole — less core blocking.
4. Longer core runs.
5. Longer bit life.
6. Less fatigue for the operator.
7. Less wear on the drill motor and hoist.

RESULT — Higher core recovery at lower cost per foot.

Here are the advantages we list in our Bulletin #201 describing the Wire Line Core Barrel

E. J. Longyear Co. MINNEAPOLIS, MINN. · CABLE LONGCO

CANADIAN LONGYEAR LTD., NORTH BAY, ONTARIO · LONGYEAR ET CIE., PARIS, FRANCE

Pioneering in TACONITE

The future of American industry is closely allied with the economic processing of low-grade iron ore reserves in Minnesota and Michigan. Because of taconite's vital importance, industry is highly interested in the progress of the TACONITE PIONEERS.

Shown here is a typical example of how one taconite pioneer uses Wilfley Sand Pumps to help solve the problems encountered in handling flotation froth . . . proof again that on even the most difficult applications Wilfley Pumps meet every requirement.

Individual engineering on every application. Write, wire or phone for complete details.

Wilfley Acid Pump
"COMPANIONS IN ECONOMICAL OPERATION"
Wilfley Sand Pump

WILFLEY SAND PUMPS

A. R. WILFLEY and SONS, INC.
DENVER, COLORADO, U.S.A.
New York Office: 1775 Broadway, New York City

CANADIAN TORNEAR LTD., NORTH BAY, ONTARIO • TORNEAR ET CIE., PARIS, FRANCE

ENGINEERING AND MINING JOURNAL

AUGUST 1955

$$T = \int_r \int_\theta \int_z \frac{1}{D}[t_d + 2\,t(r, z, \beta - \theta)]\, r\, dr\, d\theta\, dz$$

Don't turn the page—This formula symbolizes an important new management technique.

ORDINARILY WHEN WE SEE a triple integral sign, we are inclined to regard it as a tool for the specialized researcher and turn the page. Chances are that our calculus is so rusty that we couldn't begin to solve the problem. But that doesn't mean that calculus is beyond usefulness for the mine operator. On the contrary, the day has arrived when management will find it necessary to turn to it and other analytical methods to solve the complex problems that lie ahead.

This new approach, called "Operations Research," is enthusiastically described by Tom Ware in his article beginning on p 75. There, for example, he tells how a $1-million dragline was "run on paper" to determine the most productive mode of operation. Ten variables were involved in the analysis of the problem, and the formula above shows how the total excavation time (T) for the unit was determined under varying conditions of operation. Normally some 300 man-years of calculation would be required to "run this dragline on paper." But with the modern electronic calculator, dubbed the "Whirlwind," this task was performed with unbelievable speed. Results obtained were remarkably reliable and useful. Details of the "Operations Research" technique are set forth in Part II of the article on p 79, written by skilled industrial research engineers.

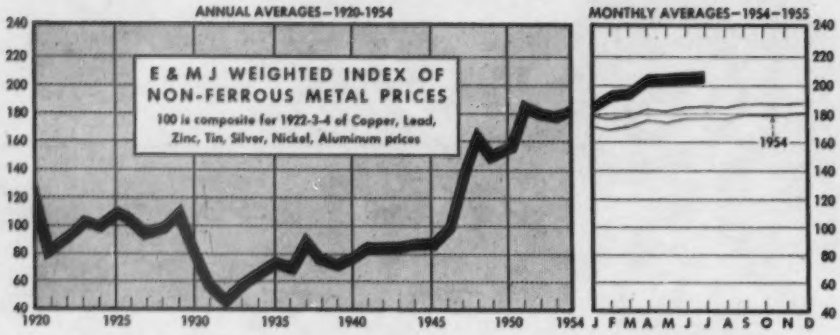
Having experienced the benefits of this successful analytical venture, Tom Ware proceeds to extrapolate and show how management can look forward to a refreshing new approach to other perplexing problems besetting mineral producers. He illustrates a flowsheet of logic termed "Decision Chains" which shows how a practical operating problem was solved. Answers derived spelled out potential savings in dollars and cents. Although the figures cited have been revised to obscure the source of information, the resulting savings of millions of dollars are representative of what might be realized by large-tonnage producers using the "Operations Research" technique.

Mr. Ware's penetrating analysis places strong emphasis on "systems balance," wherein he points out the folly of shaving unit costs blindly without first determining the impact of savings on overall costs. Here again "Operations Research" can be employed to determine real economy in the processing of a product from mine to consumer.

Thus the time has arrived when the mining industry can take advantage of the same research techniques used by other branches of industry to produce supersonic planes, guided missiles, and other ultramodern devices.

E&MJ OUTLOOK

PRICES



MARKETS

The strong situation in major nonferrous metals was intensified in July by work stoppages in U. S. mines, smelters and refineries of Kennecott, Phelps Dodge and AS&R. This hit copper, lead, silver and various by-product metals.

The E&MJ price index rose from 208.86 in June to 209.84 in July, a new high. As in June, higher averages for zinc, tin and foreign silver caused the rise. Though copper sold at appreciably higher prices in the "outside" market, producers held to 36c, delivered.

As July ended, independent fabricators were bidding higher prices for copper to keep their plants going. If the easy credit boom in business continues copper could easily rise.

Quicksilver continues to suffer from its excessive rise in late 1954. The price here has dropped $65 per flask in a seven-month period.

●

LABOR

Justice Department's petition to the Subversive Activities Control Board to determine that MMSW was a Communist-infiltrated union on July 29 may have been ill timed. MMSW immediately seized this opportunity to tell its members that the Justice Department was a strike-breaking agency.

The industry looked hopefully upon settlement of the Phelps-Dodge strike on August 2, as the forerunner of other copper strike settlements.

●

AT HOME

Two uranium prospects of commercial value found in Lake County, Oregon, have touched off a prospecting boom in that area. Run-of-pit samples assayed 0.66% U_3O_8.

Kaiser Aluminum and Chemical Corp. is investigating the possibility of building an aluminum smelter in Canada, possibly at Seven Islands, Quebec, the terminus of Iron Ore Company of Canada's railway. This plant would use hydroelectric power from the Hamilton River.

Rare Metals Corp. of America has signed a contract with the AEC to build a $2-million uranium ore processing plant at Tuba City, Ariz.

●

ABROAD

The Government of Mysore has decided to nationalize the famous Kolar gold mines on July 13, but management did "not acquiesce." The Government countered by saying that its decision was "irrevocable."

Egypt's Minister of Commerce has signed several prospecting licenses recently for groups looking for manganese, chrome, asbestos and mica in various areas of the country.

Japan is looking to Argentina as a prospective market for aluminum. Japan's exports to Argentina totaled 5,990 tons last year.

Northern Rhodesian European Mine Workers Union has signed an agreement with the Anglo-American group permitting negroes to work under 24 job categories formerly restricted to white labor.

Copper Supply Problem Acute as Strikes Cut U. S. Production

STRIKES AT DOMESTIC nonferrous metal mines, smelters and refineries cut deeply into production of copper and the entire market was in a state of wild confusion over the supply outlook as July ended. Work stoppages, viewed lightly as the month began, took a serious turn as they continued throughout July. Properties hit were those of Kennecott, Phelps Dodge and the American Smelting and Refining Co. The loss in U. S. mine output of copper was estimated at 50,000 tons. Production of refined lead and silver was down, as well as that of various byproducts.

With consumers panicky, prices were hard to control, particularly in copper. Refined silver of foreign origin advanced, but lead and zinc were unchanged. Quicksilver continued to decline. The *E&MJ* weighted index of nonferrous metal prices made a new high in July of 209.84, against 208.86 in June and 184.68 in July last year. Higher monthly averages for zinc, tin and silver caused the latest rise.

The Federal Reserve Board's index of industrial production for July is expected to hold at around 139 (base period 1947-49), unchanged from June but 15 points higher than a year ago.

Several fabricators of copper were forced either to curtail operations or to shut down completely as July ended because of inability to obtain metal as a direct result of the strikes. In some instances consumers obtained copper at premium prices in the outside market and adjusted their price schedules upward to absorb higher costs. Appeals to the Government for stockpile copper were turned down because the strategic reserve cannot be touched except in a national emergency so proclaimed by the President. Only copper not yet impounded in the stockpile can be made available in present circumstances and such tonnages at present are not large.

Controls on U. S. exports of copper were tightened by the Department of Commerce. Limitations on exports now apply to foreign-origin copper including metal treated here on toll. The third-quarter export quota is 54,000 tons.

The price situation in copper in the outside market (dealers, etc.) reminded the trade of "black market" days. Scattered business was noted here at prices ranging from 46c to 50c per pound. However, producers managed to hold to the 36c basis pending developments. The copper price situation was strong and it seemed that only a recession in general business activity could keep the price down. The Chilean authorities, struggling with serious inflation at home, have been suggesting a 40c selling basis for sales of Chilean copper in the U. S. market.

Prices realized by producers for copper sold outside of the U. S. varied considerably. The low was 35c (U. K.) and the high reported to *E&MJ* was 46c. The bulk of the tonnages disposed of sold at between 35c and 37c. The Rhodesian Selection Trust continued to move its copper at £280 in July, but advanced to £325 for August.

The May and June statistics of Copper Institute, showing production, deliveries and stocks, in tons, follow:

United States

Production:	May	June
Crude, primary	(b)95,042	91,458
Crude, secondary	11,731	11,302
	106,773	102,760
Refined copper	135,042	131,431
Deliveries, refined	(a)124,853	132,842
Stocks, refined	43,340	38,533

Outside United States

Production:	May	June
Crude, primary	(b)134,732	141,495
Crude, secondary	574	603
	135,306	142,098
Refined Copper	116,749	109,048
Deliveries, refined	108,924	115,877
Stocks, refined	176,620	171,081

(a) Includes tonnages delivered from Government stocks; also includes imports of foreign copper for account of Copper Institute members and others. (b) Corrected.

Lead production in this country was set back by the strike at A. S. & R. plants, but the situation was eased by the availability of foreign metal to relieve the market. Buying continued at a healthy rate and the price continued firm but unchanged on the basis of 15c, N. Y. Developments here helped to strengthen the foreign market. Statistics of the Bureau of Mines indicate that U. S. consumption of lead (primary and secondary) totaled 99,444 tons in May, the largest for any month since October 1953. Production of storage batteries accounted for 30,537 tons of the total consumed.

General Services Administration was in the market for both lead and zinc for the stockpile. The improved statistical position of both metals kept offers down to relatively small tonnages.

Zinc quotations were maintained throughout July on the basis of 12½c for Prime Western, East St. Louis. The undertone was firm. There is a chance that consumption will fall a little as automobile producers get into production of new models. Galvanizing appears to be off for the summer period.

Stocks of slab zinc in the hands of smelters as June ended totaled 48,612 tons, which compares with 63,184 tons a month previous and 201,124 tons a year ago. A period of heavy consumption plus stockpiling caused the sharp drop in the surplus. Shipments during June totaled 99,039 tons, of which 90,915 tons went to domestic consumers, 1,492 was for export, and 6,632 tons was for Government account. Shipments in the first half of 1955 were at an annual rate of 1,168,254 tons, which compares with total shipments in 1954 of 924,808 tons.

Tin was higher on a combination of circumstances that brought in an increased volume of business in a fairly tight market where nearby metal was concerned. There was unrest in Malaya, some delay in moving metal out of the U. K., and increased optimism over the acceptance of the International Tin Agreement. Chances for Indonesia's signing up have improved, traders believe. Forward shipment tin was available at a discount of about 3c from the prevailing spot and prompt quotations.

Aluminum was active and the supply tight. Alcoa and the unions on July 29 agreed on new wage pacts providing for a rise of about 15c an hour. This action averted a strike but greatly strengthened the price structure. The price of primary aluminum was advanced by Alcoa on Aug. 1 by 1c per pound on pig and 1.2c on ingot.

Average Prices for July (E&MJ Quotations)

Copper:	
Electrolytic, domestic refinery	35.700
Electrolytic, export, refinery	36.504
Lead:	
Common, New York	15.000
Common, St. Louis	14.800
Silver and sterling exchange:	
Silver, New York, per oz.	90.488
Silver, London, pence per oz.	78.869
Sterling Exchange, "Checks"	278.494
Zinc:	
Prime Western, East St. Louis	12.500
Prime Western, delivered (g)	13.000
Tin:	
New York Straits	96.805
New York, 99% min. (e)	95.805
Gold, per oz. U.S. price	$35.000
Quicksilver, per flask	$264.920
Antimony (E&MJ) (d)	31.970
Antimony, bulk, Laredo	28.500
Antimony, in cases, Laredo	29.000
Platinum, refined, per oz.	$82.540
Cadmium (a)	170.000
Cadmium (b)	170.000
Cadmium (c)	170.000
Aluminum, 99% plus ingot	23.200
Magnesium, ingot	28.500
Nickel (f)	64.500

Domestic quotations unless otherwise stated, are in cents per pound. Sterling exchange checks, in cents. Quicksilver, per flask of 76 lb.
(a) Cadmium average based on the producers' quotations.
(b) Cadmium average based on the average of the producers' and platers' quotation.
(c) Cadmium average based on platers' quotation.
(d) Domestic, 5 tons or more but less than carload lots, packed in case f.o.b. New York.
(e) Tin content.
(f) F.o.b. Port Colborne, U.S. duty included.
(g) Delivered where freight exceeds 0.5c.

MARKETS

Primary aluminum production in the U. S. in June was 127,632 tons, which compares with 131,128 tons in May.

Foreign silver advanced to 90¼c an oz troy on a reduction in offerings by U. S. refineries inactive because of strikes. A bill to eliminate Government buying of domestic-origin silver on the basis of 90½c is not expected to pass at this session of Congress.

Quicksilver prices continued to fall as consumers restricted purchases to a minimum. European metal sold down to $259 per flask.

Manganese ore was higher largely on the strength of the freight market. However, with steel operations at a high rate, buying interest here has shown improvement.

Turkish chrome ore, top grade, basis 48% chromic oxide, sold to regular consumers at prices averaging around $52 to $53 per long ton, f.o.b. cars Atlantic ports.

"Free" Gold Market

Volume of international gold transactions declined 33% below the June total during July due to the absence of Russian sales. Prices remained practically unchanged in Western Europe with large sales of hoarded gold in France. Asiatic markets were strong and prices continued their rise. South American markets were inactive. Pick's World Currency Report quotes on "free" gold, per fine oz, as follows:

	COINS		BARS (12.5 kg)	
	June 30	July 30	June 30	July 30
NEW YORK, transit	.....	.....	$35.10	$35.10
MANILA	$39.25	$39.25	36.60	36.40
HONG KONG	39.50	39.50	38.00	37.85
BOMBAY	54.00	53.50	53.25	52.75
TANGIER	38.75	38.75	35.05	35.05
BEYROUTH	39.60	39.65	35.19	35.18
PARIS	39.90	39.80	36.00	35.90
BUENOS AIRES	42.50	43.00	39.75	38.60

Note: Prices are computed at the free or black market value of the U. S. dollar in the local markets

Major Metals

U. S. DAILY AND AVERAGE PRICES

July 1955	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc (f) Delivered	Zinc East St. Louis
1	35.700	35.550	95.250	15.000	14.800	13.000	12.500
2	No Market	35.950	95.350	15.000	14.800	13.000	12.500
4	Holiday	36.950	Holiday	Holiday	Holiday	Holiday	Holiday
5	35.700	35.425	95.000	15.000	14.800	13.000	12.500
6	35.700	35.550	95.000	15.000	14.800	13.000	12.500
7	35.700	36.450	95.125	15.000	14.800	13.000	12.500
8	35.700	36.100	95.125	15.000	14.800	13.000	12.500
9	No Market	36.100	95.125	15.000	14.800	13.000	12.500
11	35.700	35.425	95.125	15.000	14.800	13.000	12.500
12	35.700	35.875	95.750	15.000	14.800	13.000	12.500
13	35.700	35.600	96.375	15.000	14.800	13.000	12.500
14	35.700	36.475	96.500	15.000	14.800	13.000	12.500
15	35.700	37.425	96.875	15.000	14.800	13.000	12.500
16	No Market	37.425	96.875	15.000	14.800	13.000	12.500
18	35.700	36.900	97.875	15.000	14.800	13.000	12.500
19	35.700	36.700	97.750	15.000	14.800	13.000	12.500
20	35.700	37.225	98.000	15.000	14.800	13.000	12.500
21	35.700	37.375	98.750	15.000	14.800	13.000	12.500
22	35.700	35.975	98.500	15.000	14.800	13.000	12.500
23	No Market	36.400	98.500	15.000	14.800	13.000	12.500
25	35.700	37.550	98.250	15.000	14.800	13.000	12.500
26	35.700	36.650	98.250	15.000	14.800	13.000	12.500
27	35.700	36.275	98.000	15.000	14.800	13.000	12.500
28	35.700	37.550	97.625	15.000	14.800	13.000	12.500
29	35.700	36.875	97.625	15.000	14.800	13.000	12.500
30	No Market	37.325	97.625	15.000	14.800	13.000	12.500
AVERAGES FOR MONTH							
July	35.700	36.504	96.805	15.000	14.800	13.000	12.500
AVERAGES FOR WEEK							
July							
6	35.700	35.988	95.150	15.000	14.800	13.000	12.500
13	35.700	35.925	95.438	15.000	14.800	13.000	12.500
20	35.700	37.025	97.313	15.000	14.800	13.000	12.500
27	35.700	36.704	98.375	15.000	14.800	13.000	12.500
CALENDAR WEEK AVERAGES							
July							
2	35.700	36.154	95.104	15.000	14.800	13.000	12.500
9	35.700	36.096	95.075	15.000	14.800	13.000	12.500
16	35.700	36.371	96.250	15.000	14.800	13.000	12.500
23	35.700	36.763	98.229	15.000	14.800	13.000	12.500
30	35.700	37.038	97.896	15.000	14.800	13.000	12.500

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries: tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingotbars; cathodes are sold at a discount of 0.125c to 0.15c per pound. Quotations for zinc are based on Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East, Middle West, and West, effective Jan. 1, 1951, commanded a premium of 1.35c per pound over the current market for Prime Western; Special High Grade 1.50c.

(f) Prime Western delivered where freight from E. St. Louis exceeds one-half cent.

Quotations for lead are based on domestic common lead. Corroding lead commands a premium of 10 points.

(c) The daily silver quotation reported by Handy & Harman, in cents and fractions of a cent per troy ounce, is the price paid by Handy & Harman in settlement for silver contained in unrefined silver-bearing materials submitted to them for refining. It is determined on the basis of offers of bar silver .999 fine as made to Handy & Harman for nearby delivery at New York by regular suppliers in quantities sufficient to meet daily requirements, and it is usually one quarter cent below the price at which such offers are made.

The Treasury's purchase price of newly mined domestic silver is 90.5 per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U.S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

July 1955	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	278.5312	90.1250	78.750d.	251s. 7d.	$35.00
2	(e)	(e)	(e)	(e)	35.00
4	Holiday	Holiday	78.750d.	251s. 6½d.	35.00
5	278.5729	90.1250	78.750d.	251s. 6¼d.	35.00
6	278.3660	90.1250	78.750d.	251s. 6½d.	35.00
7	278.3660	90.1250	78.750d.	251s. 9¼d.	35.00
8	278.4151	90.1250	78.750d.	251s. 9d.	35.00
9	(e)	(e)	(e)	(e)	35.00
11	278.4062	90.1250	78.750d.	251s. 9d.	35.00
12	278.3437	90.1250	78.750d.	251s. 9d.	35.00
13	278.3750	90.1250	78.750d.	251s. 9¼d.	35.00
14	278.3839	90.5000	78.750d.	251s. 9d.	35.00
15	278.3348	90.7500	78.750d.	251s. 9¼d.	35.00
16	(e)	(e)	(e)	(e)	35.00
18	278.3883	90.7500	79.000d.	251s. 9½d.	35.00
19	278.4151	90.7500	79.000d.	251s. 9¼d.	35.00
20	278.3750	90.7500	79.000d.	251s. 9¼d.	35.00
21	278.3697	90.7500	79.000d.	251s. 9¼d.	35.00
22	278.3125	90.7500	79.000d.	251s. 9½d.	35.00
23	(e)	(e)	(e)	(e)	35.00
25	278.4107	90.7500	79.000d.	251s. 9¼d.	35.00
26	278.7812	90.7500	79.000d.	251s. 7¼d.	35.00
27	279.0892	90.7500	79.000d.	251s. 2d.	35.00
28	278.8392	90.7500	79.000d.	—	35.00
29	278.7946	90.7500	79.000d.	—	35.00
30	(e)	(e)	(e)	(e)	35.00
AVERAGES FOR MONTH					
July	278.494	90.488	78.869	—	35.00
AVERAGES FOR WEEK					
July					
6	278.493	90.125	—	—	—
13	278.381	90.125	—	—	—
20	278.379	90.700	—	—	—
27	278.593	90.750	—	—	—

Calendar Week Averages: New York Silver: July 2nd, 89.900; 9th, 90.125; 16th, 90.325; 23rd, 90.750; 30th, 90.750.
(e) No Market (Saturday).

London Metal Exchange Quotations

July	COPPER Cash Bid	COPPER Cash Asked	COPPER 3 Mo. Bid	COPPER 3 Mo. Asked	LEAD Current Month Bid	LEAD Current Month Asked	LEAD 3 Mo. Bid	LEAD 3 Mo. Asked	ZINC Current Month Bid	ZINC Current Month Asked	ZINC 3 Mo. Bid	ZINC 3 Mo. Asked	TIN Cash Bid	TIN Cash Asked	TIN 3 Mo. Bid	TIN 3 Mo. Asked
1	325	326	323	324	102 ½	102 ⅝	102 ½	102 ⅝	91 ⅛	91 ¼	90 ⅛	90 ¼	731	731 ½	728 ½	729
4	332 ½	333 ½	329 ½	330	103 ¼	103 ½	103 ⅛	103 ½	91 ⅛	91 ¼	90 ½	90 ⅝	728	728 ½	725	726
5	329	330	326	327	103 ½	103 ⅝	103 ½	103 ⅝	91 ⅜	92 ⅛	91 ⅛	91 ½	728	728 ½	725 ½	726
6	330	330 ½	326 ½	327	104 ¼	104 ½	104	104 ¼	92 ¼	92 ½	91 ⅜	92	728 ½	729	725	725 ½
7	337 ½	338	332	333	104 ⅝	105 ⅛	104 ⅝	105	91 ⅝	92 ⅛	91 ⅛	91 ½	730	730 ½	727 ½	728
8	342 ½	344	337 ½	338	104 ⅛	104 ½	104 ⅛	104 ½	91 ⅛	91 ½	90 ⅝	91	728	728 ½	726	726 ½
11	340	341	336	336 ½	104 ¼	104 ½	104 ¼	104 ½	91 ¼	91 ½	91	91 ⅛	729	729 ½	726	726 ½
12	341 ½	342	337 ½	338 ½	105	105 ¼	105	105 ⅛	91 ½	91 ⅝	91 ⅛	91 ¼	732 ½	733	729 ½	730
13	346 ½	347 ½	341	342	105 ½	106	105 ½	105 ¾	91 ¼	92	91 ¼	92	740	741	735 ½	736
14	346	347	339 ½	340	105 ½	105 ⅝	105 ¼	105 ½	91	91 ¼	91	91 ½	744	746	739	740
15	348 ½	349 ½	341	342	106 ¼	106 ½	105 ⅝	106	91 ⅛	91 ½	91 ¼	91 ½	746 ½	747	741	742
18	354	355	346	347	106 ⅝	107	106 ½	106 ⅝	91 ⅝	92	91 ½	92	758	759	751	752
19	352	353	345 ½	346	106 ½	106 ⅝	106 ¼	106 ½	91 ⅝	92	91 ⅝	91 ⅝	763	764	754	755
20	350	351	342	343	106 ⅝	107	106 ¼	106 ½	91 ½	91 ¾	91 ½	91 ¾	758	759	750	751
21	354	354 ½	346 ½	347	107 ½	108	107	107 ¼	91 ½	91 ⅝	91 ½	91 ⅝	766	768	758	759
22	354	355	347	347 ½	108	108 ¼	106 ¾	107	91	91 ¼	91 ¼	91 ⅝	761	762	754	756
25	365	366	357 ½	358	108	108 ½	107	107 ¼	91	91 ¼	91 ¼	91 ½	766	768	759	760
26	370	372	362 ½	363	107 ½	107 ⅝	107	107 ¼	90 ½	90 ⅝	91 ¼	91 ½	769	770	761	762
27	363	364	357	357 ½	107	107 ¼	106 ½	106 ¾	89 ½	89 ¾	90 ¼	90 ½	765	766	757 ½	758 ½
28	364	364 ½	357	358	107 ¼	107 ½	107	107 ¼	89	89 ½	90 ¼	90 ½	763	764	756	757
29	360 ½	361	353 ½	354	107 ½	107 ¾	106 ¾	107	89	89 ¼	89 ¾	90	760	762	754	755
Av'g's	£348.345		£342.452		£105.940		£105.601		£91.226		£91.214		£747.845		£742.476	

Prices are for the official a.m. session in pounds sterling per ton. Copper basis wire bars, lead 99.97%, zinc 98% and tin min. 99.75%.

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipments f.o.b. New York unless otherwise stated, tons of 2,000 lb unless otherwise noted.

MISCELLANEOUS METALS

July 30, 1955

Aluminum ingot, 99 plus % lb			23.2¢
Antimony, spot, lb, less than carload, in cases			31.97¢
In bulk, carload lots, f.o.b. Laredo			28.50¢
Bismuth, ton lots, lb			$2.25
Cadmium, commercial sticks, delivered, lb			$1.70
Calcium, lb, ton lots, 98%, cast			$2.05
Chromium, 97% grade, lb, contract			$1.18
Cobalt, 9 to 99%, per lb			$2.60
Germanium, lb			$295.00
Indium, troy oz			$2.25
Lithium, lb, 98%	$11.00	@	$12.00
Nickel, cathodes, lb, f.o.b. Port Colborne (a)			64½¢
Magnesium, 99.8%, carloads, lb, producer's plants, Freeport, Texas			28½¢
Palladium, troy oz	$22.00	@	$24.00
Platinum (wholesale lots) troy oz	$80.00	@	$87.00
Quicksilver, flask of 76 lb, 25 flasks or more	$259.00	@	$261.00
Selenium, 99 plus %, lb	(b)$6.00	@	$7.25
Silicon, minimum 97%, carloads, lb			18¢
Tellurium, lb			$1.75
Thallium, 100 lb or more, lb			$12.50
Titanium, 99.3 plus, grade A, max. 3% iron, lb			$3.95

(a)Includes U. S. duty. (b)Depending on quantity.

METALLIC ORES

Beryllium Ore, imported, 10% BeO, per short ton unit	$36.00	@	$38.00
Chrome Ore per long ton, f.o.b. cars Atl. ports, dry:			
44% Cr_2O_3 no ratio	$22.00	@	$23.00
48% Cr_2O_3 3 to 1 ratio	$43.00	@	$53.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:			
Old Range bessemer			$10.40
Mesabi bessemer			$10.25
Mesabi, non-bessemer			$10.10
Lead (Galena), 80%, Joplin, Mo., ton			$187.85
Manganese Ore—Per long ton unit of Mn basis 48% manganese, nearby positions, subject to premiums and penalties 94 @ 96¢ c.i.f. U. S. ports, duty extra. Long-term contract nominal at 92 @ 94¢ c.i.f. duty extra.			
Molybdenum Ore, 90%, per lb of Mo f.o.b. mines			$1.05
Columbium-Tantalum, per lb. combined oxides			(a)
Tungsten Ore, per unit of WO_3:			
Foreign 60%, c.i.f. U. S. ports, duty extra	$32.50	@	$33.50
Domestic, scheelite, 60%, f.o.b. mill			$63.00
Vanadium Ore, per lb of contained V_2O_5 f.o.b. mines			31¢
Zinc Ore, Prime, 60% concentrate, Joplin, Mo., per ton			$76.00

(a) Nominal.

METALLIC COMPOUNDS

Arsenous Oxide (arsenic trioxide) lb, in bbl carload lots delivered			5½¢
Cobalt Oxide, 72½% to 73½%, ceramic grade, per lb	$1.96	@	$1.97½
Copper Sulphate, 100 lb			$12.25
Germanium Oxide, lb			$142.00
Molybdic trioxide, technical, per lb of Mo	$1.24	@	$1.25

ALLOYS

Ferrochrome 65 to 69%, per lb of Cr, (4–9% C)			24¾¢
Ferromanganese, 74–76%, net ton, seaboard			$190
Ferromolybdenum, 55 to 65% Mo, lb of Mo contained	$1.49	@	$1.57
Ferrosilicon, 50% per lb of contained Si			12¢
Ferrotungsten, 72 to 82%, lb of W contained			$3.38
Ferrovanadium, per lb of V delivered	$3.00	@	$3.25
Silicomanganese, max. 1½% carbon, lb, contracts			11¢
Spiegeleisen, per long ton, 19 @ 21% grade			$86.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds) ton:			
Crude No. 1	$960	@	$1,500
Crude No. 2	$595	@	$900
Spinning fibers	$321	@	$514
Shingle fibers	$150	@	$200
Paper stock	$109	@	$137
Waste			$77
Shorts	$35	@	$70
Asbestos, f.o.b. Vancouver, B. C. (U. S. funds):			
Spinning fiber, 3-K			$460
Shingle fiber, 4-K			$185
Asbestos, Vermont, f.o.b. Hyde Park:			
Spinning fibers	$279.50	@	$302.00
Shingle stock	$135.00	@	$162.00
Paper stock	$81.50	@	$115.00
Waste, stucco or plaster			$71.40
Refuse or Shorts	$34.00	@	$63.00
Barytes f.o.b. cars:			
Georgia, crude, per ton			$15.00
Missouri, 94% $BaSO_4$, per short ton			$13.25
Bauxite, long ton, f.o.b. point of shipment:			
Domestic crude, 50 to 52% (not dried)	(a)$5.00	@	$5.50
Domestic, chemical, 55 to 58%	(a)$8.50	@	$9.05
Domestic, abrasive, 80 to 84%	(a)$18.00	@	$18.50
Feldspar, bulk ton:			
Potash or soda feldspar, 200 mesh, ceramic grade	$18.50	@	$22.25
Glass feldspar, white, 20 mesh	$11.75	@	$12.50
Fluorspar, f.o.b. mines, bulk, 72½% effective, ton	$32.00	@	$33.00
60% effective CaF_2	$26.50	@	$28.00
Acid 97% concentrate, bulk, ton			$47.50
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00	@	$14.00
Magnesite, per ton dead-burned, bulk, f.o.b. Washington			$38.00
Mica—Domestic, f.o.b. mines. Punch 12 to 22¢ per lb according to size and quality. Sheet clear, 1½ x 2-inch, 70¢ to 85¢; 2 x 2 inch, $1.10 to $1.60; 2 x 3 inch, $1.50 @ $1.60; 3 x 3 inch, $1.80 @ $1.90; 3 x 4 inch, $2.20; 3 x 5 inch, $2.40; 4 x 6 inch, $3.15; 6 x 8 inch, $4.25. Wet ground, very fine, $140 @ $155 per ton. Bulk sales, dry ground: $32.50 @ $70.00 per ton. Scrap $25 and up.			
Ocher, Georgia, ton, in sacks	$26.50	@	$30.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports			Not quoted
Sulphur, Texas, mines, long ton	$25.50	@	$27.50
Talc, f.o.b. works ton			
New York, purified	$18.50	@	$20.00
Vermont, extra white			$13.50
Tripoli, Missouri, ton:			
40-mesh, cream colored			$30.00

(a) Nominal.

IRON AND STEEL

Pig Iron, gross ton, basic, Valley Furnaces			$58.50
Steel f.o.b. Pittsburgh, billets, net ton			$68.50
Structural shapes, Pa., Ala. etc., 100 lb			$4.50

Mining Companies Eye Northwest Areas

Major U.S., Canadian Firms Will Explore in Yukon, NW Territories, Alaskan Panhandle

UNITED STATES and Canadian mining titans are taking a long, keen look at the vast reaches of the Northwest Territories-Alaska-Arctic northland, reported to hold greatest metal potential on the continent, in light of three developments:

1. Consolidated Mining and Smelting Company of Canada Ltd., leading Canadian mining explorer, is steadily grooming its huge Pine Point Mines' lead-zinc deposits in Northwest Territories for production.

2. High-level Federal government reports that a $50-billion, 430-mile railway line is being considered to tap the fabulous Great Slave Lake lead-zinc discoveries. There are indications the transportation link would start from end of Canadian Pacific Railway steel at Grimshaw in Alberta, and strike off 430 miles into Great Slave Lake region where Pine Point is located. The rail link is a prerequisite to full development of Pine Point, and work will be stepped up when decision on railway is announced.

3. This summer five of world's largest mining companies (or their subsidiaries) will move into Alaska to carry out intensive explorations in southeast sector, adjacent to Yukon. They are: U. S. Steel, W. S. Moore Co. of Duluth; Bear Creek Mining Co., subsidiary of Kennecott; Northern Pyrites Inc., subsidiary of Texas Gulf Sulphur and American Smelting and Refining Co.

British Columbia mining men learned last month that the Federal government will soon consider whether or not it will put up the lion's share of the $50-million to build the rail line.

Northern Affairs Minister Jean Lesage and Canadian Pacific Railway's president N. R. Crump are expected to discuss the project after Lesage receives geological and engineering reports from Department of Mines and Technical Surveys who were commissioned to do the survey some months ago, and from Cominco's engineers at Trail, B. C.

In addition, economic surveys of the entire area potential are being made by government and company officials.

Cominco estimates the area contains about 60-million tons of lead-zinc ore, and Federal engineers estimate the deposit is much bigger.

But, by any standards, Pine Point is big. More than 200,000 ft of surface drilling has been completed.

This has barely scratched the surface of the 1,015-claim property which stretches in a belt 39 miles long and 3 miles wide along south shore of Great Slave Lake.

One test pit ran through better than 85 ft of massive high-grade ore, with average for entire depth about 38% zinc and 14% lead, which is probably unmatched by any orebody in the country.

Revival of interest by U. S. mining concerns stems from a number of factors. The five major outfits moving in this summer will go over deposits which have been known for some time, but ignored because of low grade and high cost factors.

New technological advances and increasing awareness that U. S. is gradually exhausting its mineral resources in U. S. are focusing new attention on Alaska.

Northern Pyrites will examine iron deposits on Latouche Island; Bear Creek is interested in copper at Green Butte on the Copper River; U. S. Steel, W. S. Moore Co, and AS&R are reportedly attracted by iron deposits in the Panhandle and to the westward.

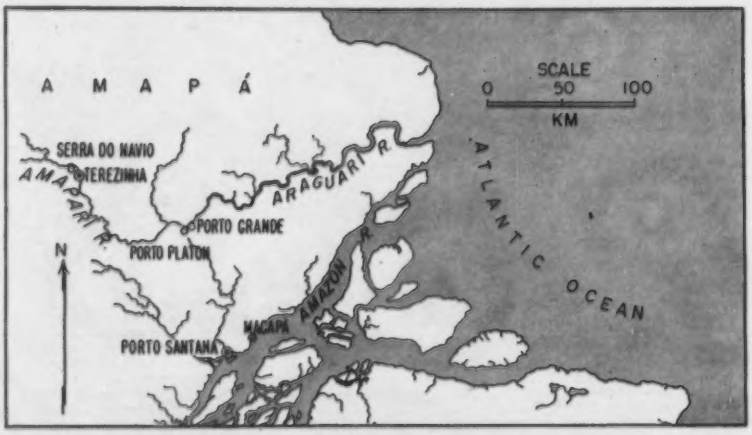
Alaska's territorial Department of Mines, instrumental in drawing attention of the big mining concerns to the north, is spurring their exploratory efforts.

In Alaska, a group of 15 modern prospectors from Tennessee has arrived for uranium prospecting. They are reportedly very well equipped and have technical personnel among them. Presently based at Willow Lake on the Richardson Highway, they have plans for other specific areas in the Third and Fourth Divisions as snow conditions permit. Aerial work will also be done.

Other U. S. and Canadian firms reportedly showing interest in the Yukon area include: Conwest Exploration Co.; Brikon Exploration Co.; Teck Hughes Gold Mines: Prospectors Airways Co.; Hudson Bay Mining and Smelting Co.; Newkirk Mines; Berens River Mines; Northwestern Exploration Co.; Bell Asbestos Co.; St. Eugene Mining Corp.; Callinan Flin Flon Mines; Yellowknife Bear Mines, and Chemical Research Corp.

Success attained during past few years in uncovering some important new deposits of silver, lead, zinc, copper, gold, nickel, platinum and asbestos has attracted numerous companies including some of the largest from eastern Canada and United States.

Among promising new areas to receive attention this summer will be Ketza River, southeast of previously discovered Pelly River Camp. Conwest is understood to be installing an assay office and making plans for extensive development program on impressive outcroppings of silver, lead, copper and gold ore which its explorations have uncovered.



ICOMI-Bethlehem Mines Manganese in Brazil

HIGH GRADE MANGANESE ORE should be moving to world markets from the Industria e Comercio de Minerios, S. A. (ICOMI), Serra do Navio mines in the Amazon area of Brazil by late 1956. Mine's expected production will be about 600,000 tons per year, with provision for rapid expansion. Development cost of the deposit will be approximately $50-million.

Serra do Navio manganese district is situated on the banks of Rio Amapari, Federal Territory of Amapá, Brazil, in an area approximately 280 miles northwest of Belem.

Dr. Josalfredo Borges, mining engineer of the National Department of Mineral Production, in 1934 furnished the first notice of the existence of manganese ore in the region of the Amapari River.

Credit for the discovery of the conspicuous outcrops and substantial possibilities of the manganese ore in the district belongs to Mario Cruz, trader.

Exploration rights in the district were granted by the Brazilian Government in late 1947 to Industria e Comercio de Minerios, S. A. ICOMI was a long established producer of iron and manganese ores with operations centralized in Minas Gerais, and, from mines there, produced comparatively large tonnages for both local and export markets. Company had long been a supplier of iron ore to the Volta Redonda steel plant.

In mid-1949 Bethlehem Steel Co. through agreement with ICOMI became a participant in the Amapá project, following which, the Brazilian stockholders formed new producing companies for operations in Minas Gerais so as to allow ICOMI to concentrate on the manganese project.

Twenty orebodies of varying size and importance are known in the district; several are connected and are designated separately only for convenience. Orebodies are arranged along a northwest-trending belt which crosses the Rio Ampari at Serra do Navio camp. All but two of the orebodies lie on the east side of the river. Total length of the known ore zone is about 8 km; largest single known orebody is 450 m long; longest extent of closely spaced or connected orebodies is 1100 m.

Exploration was principally accomplished by diamond drilling. Approximately 33,000 ft was drilled over 60% of the extension of the ore zone.

Some 14-million tons of shipping grade ore, both lode and float, are reported to have been proven in the exploration campaign. Mine life of approximately 40 years is anticipated.

Tonnage given above is based on ore averaging at least 46% manganese. Iron, silica, alumina, and alkalies in the ore are low.

Since the orebodies are exposed at the surface and do not extend to great depths they will be mined by open pit methods.

Construction work was started early in 1954. Production is expected around the end of 1956.

U.S., Britain, Sign Option On Belgian Congo Uranium

THE UNITED STATES and Britain have the right to buy up to 90% of the Belgian Congo's uranium ore production for the next two years under a new 10-year Belgian-American agreement.

Agreement, signed in Washington in June, replaces the secret wartime agreement between Belgium and the joint Anglo-American Purchasing Agency which bought all Belgian uranium production for war-time use.

U. S. is understood to be an almost exclusive buyer of Belgian uranium ore.

As we went to press . . . . .

Uranium mill which Rare Metals Corp. is building for AEC at Tuba City, Ariz., is expected to be completed in about nine months. Mill will handle ores from the Cameron area mines and adjacent areas. Plant will be located on the Navajo Reservation, 75 miles north of Flagstaff. Using "resin-in-pulp" process, mill will be built by Rare Metals crews.

Lower costs for Bolivian tin are promised with agreement between Corporacion Minera de Bolivia and the Bolivian Power Co. to supply an additional 22-million kw annually to the mines. Terms of the contract are to last until 1967.

Latest step in Australia's $12-million atomic research and development program is construction of a 10,000-kw reactor near Sydney. Plant will operate within a cylindrical steel building 70 ft high by 70 ft in diameter. Reactor itself is approximately half the size of the building, according to reports. Liquid-fuel applications will center on molten uranium fuels in the form of either molten alloys or salts. Reactor will also be used to study effects of radiation on plastics, rubber and other materials.

"Very good" and economically mineable uranium ore has been discovered in south central Oregon, according to Hollis M. Dole, director of Oregon's Department of Geology and Mineral Industries. USBM assays were quoted as 1.37% uranium oxide in selected samples from White King mine and "run of pit" samples from White King and Lucky Lass at 0.66 and 0.7 respectively. The Lake County area, where the mines are located, is in hilly pine country in the Fremont National Forest. No topographical maps of the area are available at present. White King was staked June 21 by John Roush, his son, Wyland, Mr. and Mrs. Don Tracy and Walter Leemann and son, Walter, all of Lakeview. Lucky Lass, believed to be an extension of the White King outcropping, was staked by Don Lindsey, Robert Adams, Clair Smith and L. F. Shelton, all of Lake County.

Austria's Schlaining mine is shipping stibnite concentrate to Belgian processors. See page 182, this issue.

Russia's gold output has been estimated, by a leading authority of international currency, at approximately 3.5-million oz per year. See page 176, this issue.

California's Gov. Goodwin J. Knight has begun mapping plans for a western governors mineral policies conference, to be held in Sacramento in early November. Taxes, land and water head the agenda.

Surge of interest in lithium here and abroad is not fully explained by increased industrial applications of the light metal. Most popular explanation for the budding boom in exploration and research is a carefully labeled rumor, already noted by two national weekly news magazines and reported by London sources, that Li is used in a fusion reactor. Government sources freely discuss industry uses but refuse comment on defense and nuclear applications with a firmness reminiscent of the old Manhattan Project days.

Behind the By-Lines...

G. P. Lutjen

It's perfectly alright to read that note on the cover even if it isn't addressed to you. We left it exposed when the photographer came around because it probably does as good a job as king-size type in conveying our enthusiasm for the article that starts over there, just across the page.

In case you're wondering who's Carl or who's Al, you'll find both listed on the contents page under Publisher and Editor respectively. The memo on the cover may seem like the second baseman passing a note to the shortstop, but the fact is that both these gents are pretty busy these days and lest they forget, important pieces of information are put in writing.

And believe thee us, this article on Operations Research is important. Progressive companies all over the country are reaping many shekels* through its application and mining companies can do as well or better as you will discover in the next few pages. Read it and reap.

If you're raising a crop of ulcers over the copper business, turn to page 95 for instant relief. In five pages William P. Shea blueprints the copper market from here to 1975.

Mr. Shea has been with C. Tennant & Sons for many years and enjoys a world-wide reputation as a metal market analyst. This reputation is based on thorough familiarity with markets, a wide acquaintance in the field, penetrating research and a talent for clear analysis. His copper story in this issue displays all these qualities to advantage. It goes beyond statistics, including as it does such a glimpse at the operating costs of leading producers.

Mr. Shea's byline has appeared frequently in *E&MJ* since 1940 and we asked him what reaction he usually received from his articles. He told us that the real chore of writing began when the article was published; that's when letters and telephone calls came in congratulating, arguing or seeking more information. We have a hunch that the article starting on page 95 will bring a lot more of the same. We only hope it doesn't discourage him from writing as there are a goodly number of us that are looking forward to hearing from Mr. Shea again.

Added Starter for the New Books Department: For a mere $2.50 you can get a copy of "How to Make Your Living in Four Hours a Day Without Feeling Guilty About It". Naturally the author's name is Reilly and this could well be the origin of a colloquial expression like "living the life of Reilly".

"Brainstorming" is a term you'll be hearing more of. It's a technique for producing ideas and has been tremendously successful. In essence, a maximum of 12 people sitting around a conference table are presented with a problem. At the starting signal they begin calling out ideas for solving the problem. All ideas must be positive; no negative thoughts or objections are tolerated since they stifle creative thinking.

At the end of three minutes the brainstorming is turned off. In this time, a reasonably alert bunch should be able to produce about 20 ideas. Some of them may be wild, but more than half should be sound; and even some of the wildest may be applicable.

Key points of the system are the removal of inhibitions among idea producers, and the pyramiding of ideas. Results are startling.

Latest thing we've read about the subject is somewhat disturbing. Brainstorming sessions at the Corps of Engineers Research and Development Laboratories, Fort Belvoir, Va., are being conducted by a private. Even for the army this is a bit incongruous. Seems like the brainstorm troopers could get together and produce a few ideas on how the guy could become a corporal.

Speaking of ideas—our old beachcomber friend has advised us that after a great deal of painstaking thought he has solved one of civilized man's toughest problems; how to produce a consistently good martini. The idea has all the simplicity of true genius. You merely pour a cocktail glassful (about 3 oz) of gin out of a full quart bottle and then fill the bottle with vermouth.

Lapsing into scientific jargon for the occasion, our beachcombing friend offers further amplification; "This procedure will produce an approximately 10:1 Normal solution. This solution should be kept in the refrigerator so that melting of any ice with which it may come into contact in future processing will be kept to a minimum and resulting dilution eliminated."

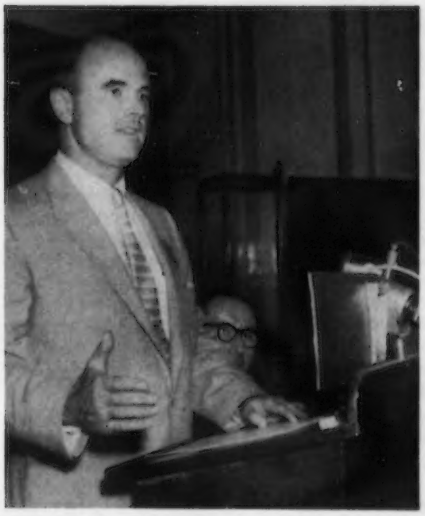
A handwritten postscript notes results of another series of experiments: "This elixir offers almost instant relief from the pangs of Gordon's Disease, a frightening malady caused by the sudden rush of blood into the ginstream."

For art lovers everywhere, we lifted this story from somebody's house organ. It seems the night porter at the house of artist Pablo Picasso in Paris helped police catch a burglar by remembering what he looked like and drawing a sketch. Picasso was impressed. A short time later his place was robbed and Picasso carefully observed the bandit who tied him up. When released he did a painting of the man and gave it to the police. Guided by the sketch, the police promptly rounded up 200 people, a horse, a hearse, an old pair of boots and a can opener.

Thought for Supervisors: When one of your men handles a job particularly well, do you make it a practice to downbraid him?

* Ancient gold coin of 252 2/3 grains worth $10.88 on the Babylonian exchange.

Operations Research and the Mine of Tomorrow* (PART I)



"A new scientific method, not yet widely understood by the mining industry, is destined to become part of management's planning and thinking for the mine of tomorrow. It's called Operations Research."

The author proves his point and shows that this technique really works with practical case histories and examples. See also Part II, p. 79, "How Operations Research Solved the Dragline Problem," written by competent research engineers who used the "Whirlwind" to make calculations that would normally require more than 300 man-years of work.

THOMAS M. WARE, Vice-President Engineering Division
International Minerals & Chemicals Corp., Chicago, Ill.

THE EXCITING SHAPE of things to come in the mine of tomorrow is revealed in the contrast between the mines of today and yesterday. This trend of accomplishments provides a firm basis for predicting a scintillating future for mining. Increasing availability of cheap power now places hundreds of horsepower at the command of the miner, thousands under the direction of the foreman. Science is providing such new aids as the two-way radio, TV monitoring, flame and supersonic drilling, gravity meters, scintillation counters, magnetometers, process instrumentation and controls, new methods of beneficiation—all of which will increase productivity.

But these new physical aids place accelerating demands on man to solve intricate problems and he now needs powerful aids to his mental processes. A new scientific method, not yet widely understood by the mining industry, is ready to meet this need. It is destined to play a major role in the next revolution in mining.

The method is Operations Research. It brings a new dimension to mine management decisions, to the search for the facts behind operating objectives. It is a powerful new tool destined to become a part of management's planning and thinking in the mine of tomorrow. But it must be thoroughly understood if it is to be useful.

* Adapted from a paper presented by the author at the Centenary Congress of the Société de L'Industrie Mineral, Paris, June 1955.

Problems Are Getting Tougher

Here are a few of the growing complexities confronting mine management which emphasize the need for Operations Research:

1. Depletion of high-grade ore reserves.

2. Increasing difficulty of finding new orebodies.

3. Soaring demands for mineral products requiring increased productivity, improved technology, and more complex machines.

4. Low-grade feed compelling cheaper, newer and more efficient mineral extraction processes.

All this means that today the decisions which mine management must make are tremendous. What's more, management's responsibilities show no signs of lessening in the future. To improve volume and yields, we are exploiting the technology of mine machinery development to where these machines are gigantic, unbelievably complex, and costly. Productivity is steadily increasing. Man's capabilities are being more fully realized than ever. An important, emerging concept in this direction is to make most effective use of the higher-order capabilities of man and thereby

optimize man-machine elements of system performance.

What has all of this to do with Operations Research? Why is it so valuable? Just this: Never has there been such a premium on ingenuity, for innovation. **It won't be long before we've exploited present methods for mining to where everything is biggest, and mine staffing is minimum.**

Operations Research—A Fresh Perspective

Operations Research provides a much needed fresh perspective. Look at any modern high-production mine. What do you find? The manager is awed at the intricate business he has created. More often than not he wishes the human mind could clearly understand its parts and working relationships.

With Operations Research the manager can analyze these relationships of the parts to the over-all objective. It's just that simple. It provides a fresh perspective approach to find answers to problems of method, costs, or principle of design.

Actually, the Operations Research man analyzes relationships and comes up with a working model on paper. His model, or formula, is an exemplification of a process or system. He, in turn, uses the terms of "process" and "system" very broadly and loosely. The model may exemplify a dragline method and its economics of operation. It may represent a total business where the optimum objective is sought.

Here, the engineer—free to interpret and speculate upon the implications of these relationships—achieves his greatest value.

The mining engineer has at his disposal relationships that he never could manipulate before, except perhaps on the slim basis of intuition or hunch. **Operations Research is his window into the future,** with all of the stimulation of adventuring over untrodden ground. **Operations Research work leads to discoveries which seem so logical that it is hard to see how they could have been missed.**

So much for the power of Operations Research to provide a new way to achieve organized thinking about truly complex problems. How about the application of Operations Research today? Forecasting the mine of tomorrow? The period of 20 to 30 years ahead? Here are some practical applications and a few descriptions of opportunities for this new decision-supporting tool.

How Operations Research Solved a Dragline Problem

First, I should like to describe the general outline of a dragline operations problem at International Minerals & Chemical Corp.'s phosphate mines, Bartow, Fla. We use large earthmoving draglines to remove overburden running 12 ft to 50 ft in thickness. These machines then dig an underlying phosphate-bearing matrix of 3 ft to 30 ft in thickness. They feed this matrix into a hydraulic transportation system which supplies, in turn, a beneficiation plant of multimillion dollar value. Our draglines cost about $1-million each. We have one at each of three mines operated in the Bartow area, our latest being a 1,500-ton unit with a 235-ft boom reach, a bucket of 26 cu yd in capacity. Our Bartow operations handle 28-million cu yd of overburden and matrix each year. The draglines not only dig but as they produce, they build the overburden into ridge forms permitting us to circulate waste water from the plant so that we may improve and re-use it.

When we decided to conduct an Operations Research investigation to optimize the draglines' performance, we visualized three sizable responsibilities in this operation: (1) **maximum utilization of capital invested** in the machine; (2) **supplying the plant at a predictable rate,** uniformly and with attention to quality; (3) **successful recovery of our ore reserves** which are literally dug by the hands of one man.

The dragline performs a highly repetitive type of task that may add up to as many as 1,500 cycles a day, a cycle very generally being composed of digging, transporting, depositing, and return elements. We soon found that swing angles were important, so were dragline walking distances and many other factors. With the aid of expert mathematicians (see description of research which follows) and by use of time studies, we then identified the principal factors which related to dragline performance. Next, we set up a formula that defined relationships of those factors selected to plan for optimum performance of this $1-million machine.

What We Learned

What were the results of this work? We found that there were many factors in dragline operation, more than we had cared to consider. Above all, our mathematical model showed us that our dragline operating methods comprise a rigid system; we couldn't change one factor without affecting another, or several others to be more precise.

The essence of our work shows ten factors to be vital; they include not only the angles of swing and the length of walk, but also considerations for thickness of matrix and overburden, time of performance for each element, relationship of the position of our hydraulic sump for receiving the matrix, position of the spoil pile for overburden, width of the cut to be made, position of the machine with respect to the cut. Many limiting circumstances were established, some established by the characteristics of the machine, such as the boom length and the rate of swing, and others established by the nature of the task such as the mechanics of the soil structure and the angles of soil response.

300 Man-Years of Calculations Required

A formula was created that did not look like very much more than a theory. Set up in a high-speed digital computer, **which performed the equivalent of over 300 man-years of computation,** the model delivered immensely practical results. We had then, for the first time, a true picture of the relationships between key factors.

I used the expression earlier of "a window into the future." That, as nearly as I can describe it, is what Operations Research has provided for us as a result of our dragline studies. Now we have performance standards against which to evaluate our operations, or with which to predict and plan. We can compare one plan for mining against another, all on paper without the expense of actual field trials. Such plans can be projected years ahead, backed with confidence. **We can even see the effects of machine design on our own business economics.** Using our new Operations Research tool we are free to synthesize and determine the impacts of changing equipment component designs.

But the biggest advantage of all is reflected in our staff, with whom this work was originally developed. It means a great deal to know that the decision path ahead is paved and clearly marked. **Our thinking is no longer completely empirical.** We have a new-found enthusiasm for what we do in dragline mining.

Systems Balance and Equipment Use

Taken alone, there are some who would be critical of our dragline mining studies. Rather, they would prefer to apply the Operations Research technique to the whole system of mining and processing before going into any detailed analysis for optimizing performance of one machine. They are right. To deny this would be inconsistent with the aims of Operations Research which make it possible to realize the full potential of detail work such as our dragline study.

Our Operations Research viewpoint of necessity had to expand. We now speak of a systems balance, relating proportionately all of the process steps, from the mine through the plant. We do this in a more thorough way than it has ever been done before, using a high degree of specialized talent. Our job is to link the plant, the mine and its reserves so that capital and labor are used efficiently to satisfy our market, to make a profit. We find this the only true point from which we can start if we are to get maximum benefit from Operations Research. It's the basis for any equation. And it will be of fresh significance to tomorrow's mine and plant.

Following the example of the chemical processing industry, in the future mine-mill management will place more emphasis on process economics. **Through Operations Research, management will learn how one department of a plant may cut its costs and increase its profit at the expense of another part of the plant in subtle ways it has not been able to recognize before.**

Management will find that it can no longer just issue a command to keep costs down in one department. It must be more specific. It must set limits of control in one department and probably expect to shift limits of control for one or several others at the same time.

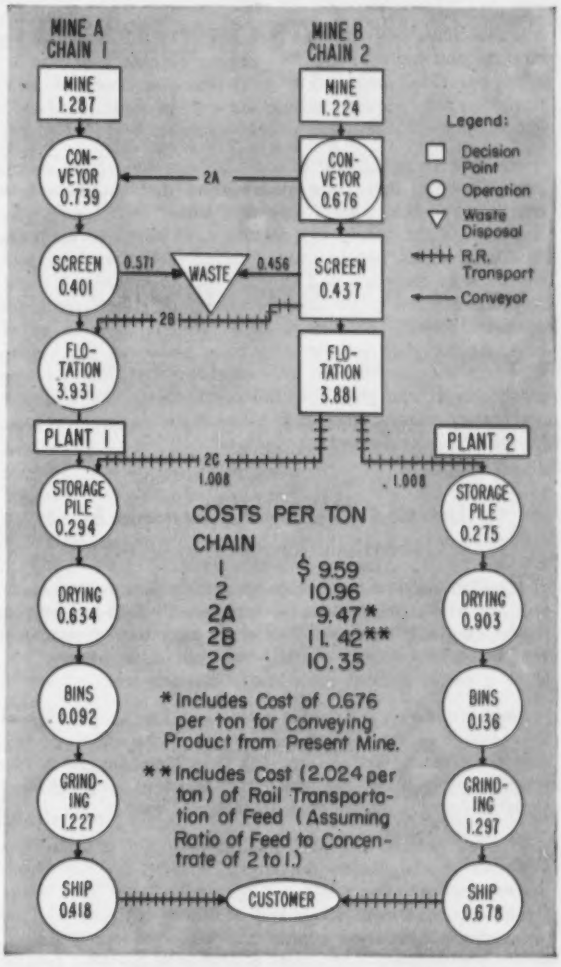
Process economics have become so complex that management must go back to an all-encompassing objective to determine the compatability of new processing ideas, whatever form they are to take. We will no longer be able to afford the quick decision-making which was known in the days of the simplest plant. **There will be less room for trial and error.**

To be sure, there always has been primary effort devoted to a proportioned relationship between the mine and mill. With the "research on operations" approach, however, this relationship takes on a new meaning. There will be more precision found in these ties than we have known. Our attention will be focused differently in our search for cost improvements, more on principles of operating economics. We will seek entirely new concepts for equipment performance evaluations as we isolate high cost elements to tear these down into their composite structural purpose and theory. Actually, since in Operations Research quantitative-qualitative relationships are established, relating parts of the process, we shall have the freedom to speculate about changes and their effects on the system using analog models or other devices with which to experiment and analyze. And, as we begin to search scientifically for better understanding of mine-mill process relationships, our past efforts to coordinate and balance operations, will probably appear crude by comparison.

With the loss of flexibility that goes with our efforts to improve mine-plant efficiency for processing ever lowering grades of ore, the mine engineer will begin finding his Operations Research opportunities in most of the complex operating relationships with which he has been struggling. Intuition and experience can be a guide. For example, the surge effects between the mine and plant occasioned by the

(*Continued on next page*)

Illustration of the "Decision Chain" Method for Broad, Objective Analysis of Mine-Plant Operations



A Picture of Opportunity

THE ABOVE FLOWSHEET is more than just a process flowsheet. It's a flowsheet of management decision—not just in theory, but one which can save millions in operating costs.

In this case Mine A has a preparation plant (Unit No. 1), but Mine B's production is beneficiated at preparation Unit No. 2.

There are four points in Mine B's operation where management can make a decision: (1) at the mine—to operate or not to operate, (2) to continue to convey to Chain 2 or convey to Chain 1, (3) to wash and beneficiate, or to wash and ship to Chain 1, or (4) after beneficiation to ship to Chain 1.

Squares indicate decision points. Costs are shown at each point in the chain. Thus it is a simple matter to select any combination of operations and determine results of the decision. If management chose Chain 2A to replace the present Chain 2, a savings of $1.49 per ton would be realized. Assuming Mine 2 produced 2-million tons, the use of Chain 2A would save $2,980,000 annually. Savings per ton and production and unit cost figures have been modified to obscure the source, but the magnitude of savings is representative of those involved in an actual management study.

Thus we see how this type of analysis reveals a picture of potential efficiencies that cannot be overlooked. Add the estimates of capital needs that can bring the system into balance to that of the lowest cost chain, and you have an opportunity picture defined. . . . Simple?

mine variables of mineability and geologic occurrence may need costing to yield a basis for development of method or equipment that will minimize these effects. The full advantage of proper in-process inventory quantification at each process stage can come out of such studies. Better methods for planning and scheduling between orebody, plant and market may well become an objective to displace the stresses and highly inefficient results obtained by an "off-again-on-again" production program. The need for additional instrumentation and control may be established more specifically suiting process requirements.

Since this may appear to some mine managers as simply better costing, **there is a qualification that should not be omitted, "costing with a scientific basis."** Most assuredly, the mine of the future will require more sensitive measures of cost controls. Better understanding of the working relationships of the parts will sharpen our "cost center" thinking as we learn more about causes and effects from the scientist. Finally, benefits to be derived from team effort, bringing together people who have no roots in mining, such as the statistician, the mathematical theorist, the climatologist, the physicist, the psychologist, the biologist, and many others who can concentrate on process economics, will be important.

Decision Chains—An Example of Operations Research at Work

An Operations Research team getting into cost analysis will apportion cost factors scientifically. **Before you realize it, the company's process flow sheet may be redrawn in a cost form that would startle you with its simplicity.** The form is referred to as á chart of "decision chains."

Decision chains are similar to the well-known production flow charts of the industrial engineer. They differ in two subtle and important aspects: **(1) They highlight the points where management can render a decision; and (2) they show the effects of decisions in terms of money.**

We can give you a good example of cost relationships that can be clarified by an over-all view of a system and the reward for doing so. It comes from a well known operation whose identity I am not at liberty to reveal. This operation includes two mining components and two preparation components. The inter-relationships between two of the mines and the two preparation components are illustrated graphically on p 77.

Operations Research presents the whole picture, not just a portion of it. It is a broad enough "tool" to develop the true cost effects of such things as surges between the mine and the plant; to develop the desirable product inventory relationships between the mine, the plant and the storage piles; to evaluate the desirable process control values with their limits; and to determine the desirability of a host of new instrumentation and control devices. But, whether it comes to comparing new principles of mining such as the continuous miner or new principles of processing just now on the horizon, this Operations Research technique can prove helpful. Management, in any event, will find its decision points clear.

For Exploration—A Factor of Confidence

Proving out an ore discovery in both grade and tonnage is the most important step in any mine's future. Based on this work, tremendous investments are made. Decisions for plant design and mine layout are made which affect operating costs for the life of mine and plant. It doesn't take long to realize that a few pennies per ton in this stage of decision making can add up to a large sum during the life of any mine. This is particularly true of any mine with orebodies that run very deep, or which may lie under deep cover.

In the past, men of great courage were able to make these decisions and live by them. Today, ore reserves are so difficult to locate, and their cost of development is so high, that there are greater penalties for errors in decision making, notwithstanding the normal risks from competition.

Operations Research can take a lot of the guesswork out of proving up the ore reserve and planning the mine layout for optimum performance. It can provide an excellent opportunity to complement the work of the exploration and mining engineers at relatively little cost. Again, the relationship of known data to decision-making opportunities can be clarified in ways that have not been familiar before.

Consider, for instance, the proving-out of ore reserves for grade and tonnage. If you have been fortunate enough beforehand to have mined in a similar formation in a certain vicinity, it will be possible to define certain characteristics of the formations mathematically. The mathematical probability of success for any given amount of exploration drilling can be established. **The hit-or-miss grid technique may be redefined in a specific arrangement,** or alternatively a "factor of confidence" can be placed on the drilling that has been carried out using empirical technique. The number of holes required for a given accuracy of definition of the orebody can be determined, too.

Better Mine Planning

When all that can be learned about the deep mining type ore reserve has been determined with a high degree of reliability, the Operations Research technique offers still more benefits to the mining engineer in mine planning. Here it will be possible to synthesize mine development and operation to realize lowest cost operating layouts. Again, Operations Research won't displace the mining engineer. But it can augment his efforts to plan and design an efficient mine in many ways. Haulage systems planning, panel arrangements, development programming, room and pillar sizing consistent with roofing limitations and operating equipment requirements can be established. In the case of block caving systems, values can be placed on the various parts of the system to enable optimization of yields, optimization of haulage costs. It may be that the long established empirical design relationships that exist in blasting can yield to Operations Research analysis for improved efficiency and effectiveness.

Certainly the shaft can be located with better predictability of ore grades. Certainly the costs and values of shaft design features can be established well ahead of time so that the management realizes the full extent of its initial decisions in this regard. "Kinks" in a haulage system can be avoided. While Operations Research cannot guarantee that this won't ever happen, it can certainly be employed to reduce this possibility.

Mining's New Frontier

Never has there been more romance and opportunity in mining. The excitement of mining is no longer in the mere discovery of a new ore. The thrills ahead lie in tying together all of man's new-found scientific methodology now being spun with the increased complexity, size and cost of mine and plant.

Operations Research is a part of the engineering frontier. Management will welcome it as a vital part of planning and decision making in the mine for the atomic age.

How Operations Research Solved the Dragline Problem* (Part II)

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Dunlap and Associates, Inc., Conn.

TOM WARE HAS OUTLINED the dragline problem which was solved by the Operations Research technique. The following pages describe the step-by-step procedure by which professional research engineers set up and worked out the problem.

A mathematical analog was developed to simulate operation of the mining system in such a way as to predict consequences of alternate methods under consideration by management. Results of management decision could be predicted in terms of cost and value.

These predictable results were then translated so that they could be applied in routine operation by management.

Three steps were involved in this research problem:

1. Formulation of the problem.

2. Research and model development.

3. Translation and implementation of the results.

Dragline Operation in Brief

The draglines under study remove overburden 12 to 50 ft thick. Underlying phosphate-bearing matrix varies from 3 to 30 ft thick. Bucket capacity is 26 cu yd. Draglines dig the matrix which is transported by hydraulic methods to a beneficiation plant. Overburden is cast into ridges to permit circulation of waste water from the plant for reuse.

Four steps to make up the operating cycle:

1. The bucket is positioned at the digging point and dragged inwards until filled. See Fig. 1.

2. The machine is rotated until aligned angularly with the dumping point; at the same time the bucket is hoisted up to the boom tip in preparation for the dumping step.

3. When the bucket reaches the end of the boom it is inverted and dumped.

4. The machine is again rotated while the bucket is lowered to the drag position, preparing it for the next cycle.

The operating cycle contains two swing elements (during which the bucket is raised or lowered) that depend on the relative locations of digging and dumping positions. It also contains two elements (drag and dump) that do not depend on relative location. The machine is so constructed that dumping can only take place directly below the boom tip.

The mining operation itself consists of a series of excavations performed successively to form straight line cuts or strips. A single excavation with a strip may be as large as a semicircle having a diameter of over 400 ft and containing an area larger than a football field. Following each unit excavation, the dragline walks back to a new position along the stripping line to begin the next excavation.

The overburden is disposed of by spoiling it back into a previously excavated area or mounding it up somewhere inside the excavation to form dams, which may then be used as a reservoir for process wastes. The phosphate rock on the other hand is dumped into a previously constructed pit known as a well which is located on the surface immediately adjacent to the strip. At the well, it is broken up by high pressure water guns to form a slurry, and pumped to the processing plant. Wells, pumps, water guns, and pipelines are moved each time the machine moves. The typical form which such a series of stripping excavations will take is shown in Fig. 2.

Maximum Return on Investment Is the Target

In the formulation of this problem it was agreed that maximum return on investment could be taken as the criterion of optimality. This immediately suggests the three value criteria which determine the utility of any mining

* Adapted from "Strip Mining Phosphate Rock with Large Walking Draglines—A Problem in Operations Research" published in the *Journal of the Operations Research Society of America*, February 1955.

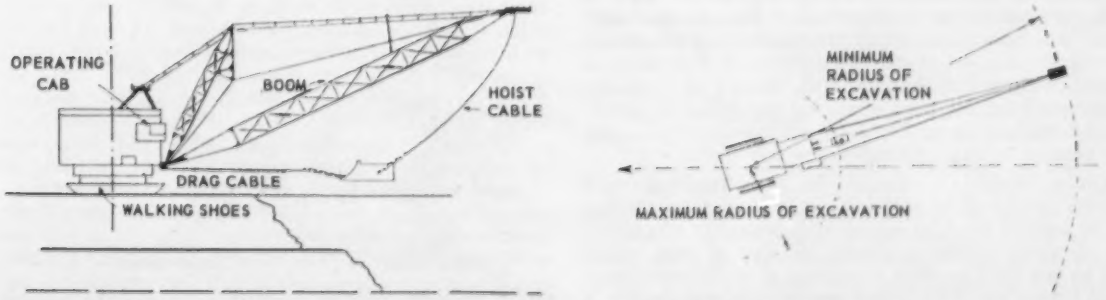


FIG. 1. Principal operating parts of dragline. Research project ran this huge machine "on paper" to find optimum performance.

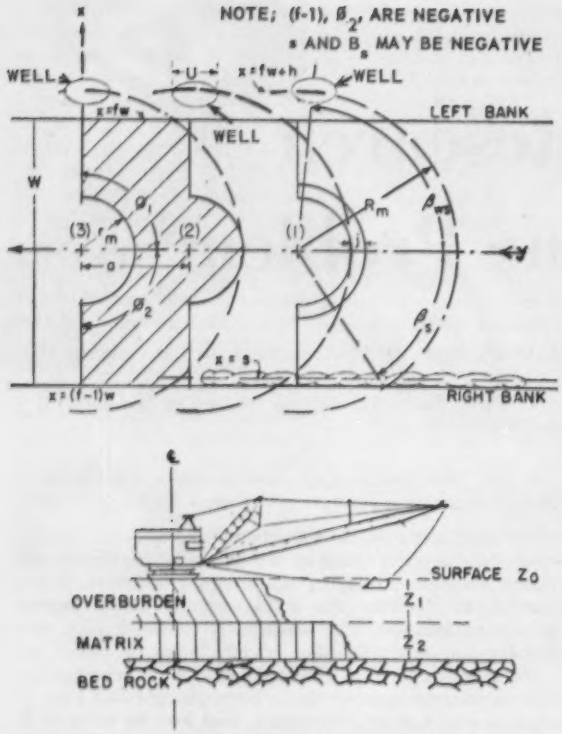


FIG. 2. Major design variables (actually 10) that had to be juggled mathematically to determine best operating conditions.

operation: yield value, cost of yield, and investment. There are, of course, other less tangible values which are recognized in the extraction of minerals, but most of these were essentially irrelevant to this study.

The range of alternatives that constitutes the area of decision was restricted to the level of the mining operation itself in this study. Furthermore, from the entire set of alternatives only those were considered that did not necessitate major investment, new equipment, or serious modification of existing equipment. This was a restraint imposed on the problem collaboratively with management officials. Remaining alternatives constitute what might be referred to as a family of operating patterns for the mining operation. The selection of any of these patterns is equivalent to a specification of how the machine will be employed. The selection of the best of these patterns (for any set of conditions) is the decision-making problem which the mining superintendent must face routinely.

Stripping Restricted to Straight Lines

Additional constraints were imposed on the study in order to maintain the basic process of stripping in straight lines. That is, odd-shaped and curving strips were excluded, principally because of the impossibility of organizing an operation along such irregular lines. Besides, such extreme departures from current practice did not appear to contain enough intrinsic promise to outweigh the need for keeping the research within reasonable economic limits.

Given constant investment, the two remaining value criteria correspond to yield and cost of yield. Since the cost of an hour of machine operation is negligibly affected by the operating pattern employed, the first of these values can be expressed in terms of mineral production per operating hour. Cost of yield then can be expressed directly in terms of cost per operating hour (constant) plus auxiliary costs per unit of yield produced involved in the operation.

Auxiliary costs referred to include such things as the cost of the land, cost of constructing wells, and waste disposal costs. Each of these is affected by the choice of an operating pattern. The problem therefore becomes one of determining the relationship between the two value determinants, yield and cost of yield, and the various factors that together constitute the pattern of operation.

In other words, this study had as its first objective the establishment of decision-making bases with respect to the mining operation. These bases were seen to consist of the set of relations linking yield and cost of yield with choice of operating pattern. Given such a set of relations, decisions can be made which will be near-optimum in the sense that they can be expected to result in maximum return on investment as compared to any alternative decisions.

There are other circumstances that, on occasion, may introduce more complicated elements into the decision-making process. For example, there will be times when decisions must reflect economic problems relating to the operation of the processing plant, the utilization of leaseholds, and equipment maintenance and repair. An outage at the mines may require a period of higher production to keep the processing plant operating, even though the mining cost per unit of production is higher. Similarly, swampy ground might necessitate machine movings more frequently than might otherwise be dictated by the economics of the process. Geological conditions (meaning the relative depths of the overburden and mineral layers) will fluctuate uncontrollably, and thereby require a constantly changing pattern to preserve the operating optimum.

Development of the Problem

The first active research step was the identification of those operating variables which contribute to value and cost by virtue of their effect on productivity and auxiliary mining costs. For the most part, this was an inspection operation carried out with the aid of mining officials and operators. It resulted in identification of about 25 factors of seeming importance. From these, there were finally selected ten variables which were believed to exert major influence on the value elements under consideration. Again the simplification was one dictated by the need to keep the study within economic limits. Careful consideration seemed to suggest that those variables which were excluded would have very small effect. This was, however, principally a matter of judgment. The elements in the mining pattern which were finally selected as "operating variables" are presented in Table I.

The physical meaning of these variables is demonstrated

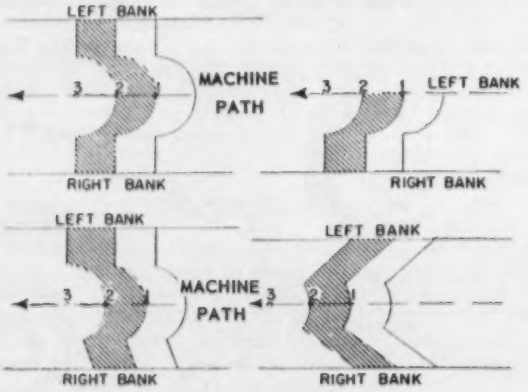


FIG. 3. Four different digging patterns which could be obtained by changing just a few of the variables in the computations.

Table I. Ten Significant Operating Variables

Operating variables	Typical range of variation
Width of strip (w)	10–450 ft
Depth of overburden layer (z_1)	6–50 ft
Depth of mineral layer (z_2)	3–30 ft
Minimum radius of excavation (r_m)	50–200 ft
Maximum clockwise angle of excavation (ϕ_1)	0–130 deg
Maximum counterclockwise angle of excavation (ϕ_2)	0–130 deg
Location of the machine within the strip (f)	0–1 (fraction of distance across strip)
Location of the sumps (p_s)	100–600 ft apart
Distance between excavation centers (a)	10–150 ft
Disposition of overburden (s)	anywhere along arc of 200-ft radius

in Fig. 2. Fig. 3 illustrates typical variations in the operating pattern which can be effected by changes in about half of these variables.

The next and perhaps the most important research step was to find the set of relations which link each of these variables to yield and cost of yield. These relations would in effect serve as the "model" of the mining operations to be used for predicting the outcome of any pattern of operation.

Purely empirical methods of study could not be considered seriously. Even if experiments could be designed that would not interfere with production requirements, the magnitude of the data-collection problem precludes such an approach. The collection of a unit datum might require as long as a month. Even in the absence of statistical variability, the number of operating variables to be studied would require perhaps a hundred years of data collection before the desired relations could be deduced.

Reliable Synthetic Operation Must Be Set Up

This leaves as the only alternative the establishment of a synthetic operation that can be manipulated much more rapidly. The problem, then, becomes one of constructing a mathematical analog based on the elemental motion-time characteristics of the total man-machine system.

Before proceeding to the detailed development of this model, it might be profitable to discuss some of the intuitive considerations that underlie it. For example, it is implicit in the problem that the larger the volume of each unit excavation, the greater will be the average time of each machine cycle. The reason for this is that the mean distance between digging and dumping points will increase. If the unit volume of an excavation is made smaller, more time will be spent in unproductive walking from one excavating point to the next. From a productivity point of view, this suggests the existence of an optimum between digging and walking time. Furthermore, this optimum will be a function of the shape of the excavated volume that will depend on the width of the cut, the radial and angular limits of excavation, and the lateral path of the machine within the strip. It will be affected further by the depths of overburden and matrix (phosphate rock), which cannot be expected to be invariant over more than a brief time period. Finally, since the location of wells and the disposition of overburden fix the dumping points for these two materials, the selection of these two factors will influence the optimum. These in turn contribute to economic and other elements of the decision process. That is, the spacing of wells will help determine the cost per cubic yard of phosphate mined. Similarly, the way in which overburden is mounded up or spoiled determines the reservoir capacity for containing slime and mud effluents from the phosphate processing plant.

Development of the model took place in two stages. The first consisted of an experimental determination of the basic operating characteristics of the man-machine system. The second consisted of the development of a mathematical description of the excavation process, which had as its parameters the physical variables that characterize the mining operation. As will be seen, the mathematics required for this purpose was essentially simple and straightforward.

The operating characteristics of a dragline include those associated with both walking and digging. As mentioned earlier, the digging cycle is made up of four elements, two of which, dumping and dragging time (t_d), can be thought of as constant. These were determined empirically. For reasons never quite understood, they were found to be significantly different for the moving of overburden and matrix.

The other cycle elements, involving bucket movement and machine rotation, have a slightly more complex structure. Without going into detail on the point, theoretical consideration of the machine's dynamics indicated that: (1) machine rotation time should vary with the square root of the swing angle, and (2) bucket translation time should be controlled by the drag cable speed. The latter factor could be approximated by a linear function of bucket position.

Remembering that machine rotation and bucket movement are performed more or less simultaneously, over-all swing time will depend on both of these. If operators were perfect, the limiting time would be the larger of the two. Observation revealed that this was not so, with the consequence that a fairly complex function, $t\ (r,a,z)$, was required to describe the actual performance. Swing-time data were collected for all operators over a wide range of operating conditions. The performance function fit to these data was used to represent the swing elements of the digging cycle. Incidentally, the data suggested that swing performance did not vary with bucket load, material, or swing direction.

Time Required to Walk a Dragline

The time required to walk a dragline can be approximated by the linear function:

$$T_w = t_{pr} + (a/l)t_s$$

where

T_w = time required to walk through distance a,
t_{pr} = time required to shut down machine, prepare to walk, and to resume operations after walking,
a = length of walk between excavations,
t_s = time per step
l = length of each step

The constants t_{pr}, t_s, and l were determined by observation of a large number of machine moves.

Proceeding to the model itself, the rate at which mineral phosphate can be mined has four components:

1. Matrix volume transported to the well (V_m).
2. Walking time (T_w).
3. Overburden excavation time (T_o).
4. Matrix excavation time (T_m)

Of these components, all but the last will remain constant from one excavation position to the next. However, because it is possible for the position of the well to change with respect to the position of the machine, matrix excavation time may vary with successive excavations. Any changes which do occur in relative positions of machine and well will generally result from utilization of the same well for more than one excavation. However, since wells

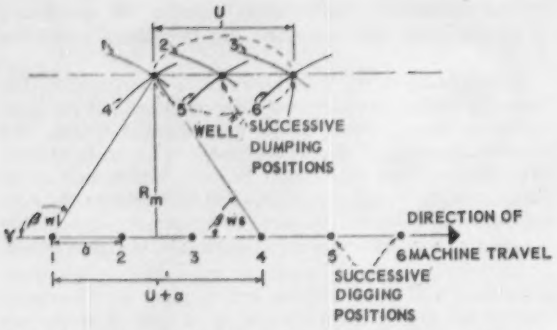


FIG. 4. Studies were made of successive digging and dumping positions for short and long angle swings to the well.

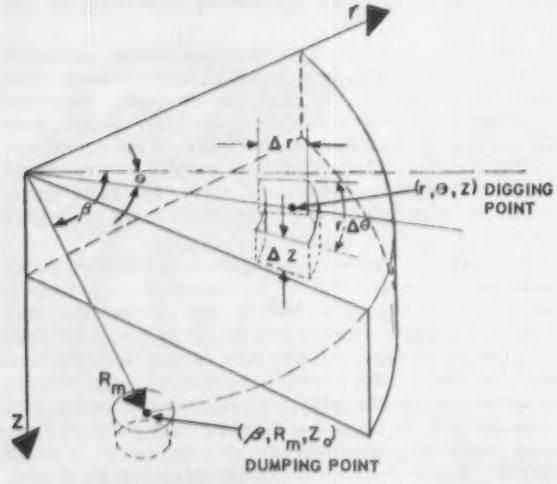


FIG. 5. A cylindrical coordinate system was set up for mathematical analysis of variables involved in digging operations.

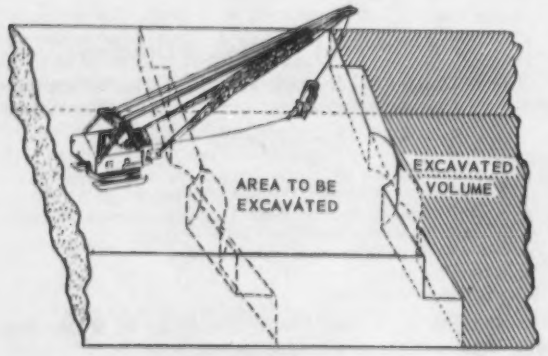


FIG. 6. Typical excavated volume by the dragline is shown in the above three-dimensional study diagram.

are constructed to run approximately parallel to the excavated strip and since dumping must take place at the end of the boom, only two sets of machine and well positions are worth considering (for any given pattern of operation) when the machine is restricted to linear movement along the strip. For one of these positions, the angle to the well (measured from the reference axis passing through the machine and running parallel to the strip) will always be small (less than 90 deg). For the other, it will always be large (greater than 90 deg). This point is illustrated in Fig. 4.

The basic mining rate equation is given by:

$$R = V_m/(p_s T_{ms} + p_l T_{ml} + T_o + T_w)$$

where

V_m = volume of matrix transported to well per unit excavation,
T_w = walking time between excavation points,
T_o = overburden excavation time,
p_s = proportion of excavations with the well in the 'near' position,
p_l = proportion of excavations with the well in the 'far' position,
T_{ms} = matrix excavation time with the well in the 'near' position,
T_{ml} = matrix excavation time with the well in the 'far' position.

How Total Excavation Time Was Derived

Referring to the pie-shaped volume in Fig. 5, we see that time required to move the incremental volume

$$\Delta v = r\Delta r\ \Delta\theta\ \Delta z$$

from any digging position (r, θ, z) to the dumping point (β, R_m, z_o) is

$$\Delta T = (\Delta v/D)\ t(r, \alpha, z),$$

where

D = bucket capacity,
ϑ = angle measured from reference axis to digging point,
β = angle measured from reference axis to dumping point,
α = the swing angle, $\beta - \theta$.

The total excavation time is simply the sum of all the incremental times,

$$T = \sum_v \Delta T = \sum_r \sum_\theta \sum_z \frac{1}{D} [t_d + 2\ t(r, z, \beta - \theta)]\ r\Delta r\ \Delta\theta\ \Delta z.$$

Letting Δr, $\Delta\theta$ and Δz approach zero and replacing the summation by integration,

$$T = \int_r \int_\theta \int_z \frac{1}{D} [t_d + 2\ t(r, z, \beta - \theta]\ r\ dr\ d\theta\ dz,$$

where the limits of integration correspond to the boundaries of the excavated area and can, therefore, be presented as functions of eight of the ten operating variables (width, depth of overburden layer, depth of mineral layer, minimum radius, limiting clockwise and counterclockwise angles, lateral position, and distance between excavation centers). The angle β, which appears in the integrand and which corresponds to the angular position of the dump, will vary as a function of well location, overburden disposition, width, and walk distance factors.

A separate expression is required for each of the times T_{ms}, T_{ml}, and T_o because the volumetric shapes and/or dumping positions will be different for each of these. In addition, the irregular and discontinuous nature of these shapes (as illustrated in Fig. 6) requires further separation of each integral into several parts.

Logical Constraints Were Recognized

Along with the basic productivity model, a large set of constraints must be attached to exclude impracticable digging situations or patterns which the dragline is incapable of following. For example, the distance walked between excavations must always be greater than the drag distance required to fill the bucket and less than that which will result in unreachable pockets of matrix. Altogether, there were about 20 constraint functions that set limits on one or more parameter values given values for the remainder.

Associated with this development there were additional models to represent such things as well-utilization factors to be used for determining well cost per unit of yield. Together, this set of models made possible the simulation of

the mining operation over a wide range of alternative operating patterns. At this point, it was now possible to predict the outcome in terms of yield rate and cost rate that could be expected for any set of operating decisions.

The final form of this model proved to be elaborate, presenting problems of computation that could not be easily solved by ordinary means. This resulted from the irregular volumetric shapes as well as from the fact that each solution required nine separate numerical cubatures. In addition, it was desired to replicate these solutions for several different types of draglines, each of which possesses a different set of operating characteristics—necessitating separate models for each mine.

Furthermore, a single optimum does not exist for this operation because of the continual variation in geologic conditions (depth of overburden and mineral layers), as well as associated cost considerations that derive from other parts of the mining operation. These considerations pointed to the need for separate solutions for the entire range of alternative patterns. Since the productivity model contained ten parameters, each of which related to a particular variable in the pattern of operation, the number of separate solutions required for complete evaluation of the alternatives runs into the millions. For this reason it was necessary to carry out the total set of solutions on a high-speed computer.

Predictions Prove Reliable

To establish validity of the model, data were collected on mining performance for each of several operating patterns. It was found that these empirical results corresponded to those predicted by the model within acceptably small limits of error. Error estimates were made in order to establish confidence limits for decision-making purposes.

Application of Results

The results which were yielded by this study immediately suggested strong possibilities for bringing about improvement in the mining operation. This study demonstrated that in terms of productivity alone, there existed a ratio of about 2:1 between the best and poorest possible performance levels. Furthermore, current operating practices corresponded to a performance level that was closer to the poorest than the best, thereby promising a potential return of somewhere between 40 and 50% improvement. Subsequent results have substantiated this expectation.

It was clearly realized that no matter how imaginative the research phases of this study were, the bases which it provided for decision-making had first to be translated in such a way that they could be made to form a part of the routine managerial system. Accordingly, a program was devised with the objective of making this new decision-making tool both acceptable and useful to the operating management. A number of steps was planned to accomplish this goal. These will be reported here because of the importance of this often neglected phase of operations research.

How the Plan Was Made to Work

During the course of the study itself, every effort was made to develop a feeling of sponsorship at all management levels for this research problem. Management was asked to help formulate the problem itself, identify operating variables, establish the problem and study limits, collect field data, and describe unusual operating circumstances. Periodic progress reports were made during which company officials were brought along with the study and given the opportunity to propose modifications and additions. At the conclusion of the research phase, formal presentation was

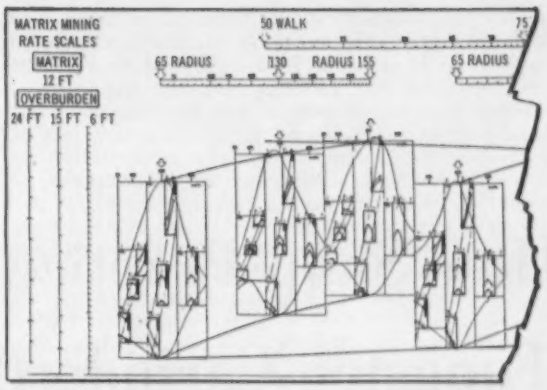


FIG. 7. Here you see the dragline operations worked out on paper, predicted reliably to guide decisions by management. More than 300 man-years of calculations were involved.

made to the complete management hierarchy from the president down to the assistant mining superintendents. Considerable pains were taken at that time to develop an appreciation for and an acceptance of the mathematical model used to simulate the mining operation.

During the test period, which was used to demonstrate the validity of the model, management officials participated in the collection of operating data and the appraisal of results. One of the investigators lived with the operation for over three months in an effort to help train operations personnel to use the results of this study.

Painstaking attention was given to presentation of these results so that they could be readily interpreted and applied. For example, many special charts were devised to give a graphical picture of the interrelations between the ten variables constituting the operating pattern and yield. See Fig. 7. Because of the complex character that even this simplified presentation assumed, a special handbook was prepared to facilitate its interpretation.

Finally an operating manual was prepared in which the entire mining operation together with the effect of all operating variables on yield and cost of yield was reviewed. This included verbal and graphical descriptions of each of the operating variables, a set of nomographs to be used for determination of such things as operating hours per well, location of machine path, etc.

A number of by-products developed out of this study, which were not originally anticipated. These included such things as the development of performance standards and production quotas, facilitation of the economic mining of low-grade resources, the establishment of a rationale for improving dragline design characteristics, the training of operations personnel in the characteristics of a mining system, and provision of information for evaluating land resources.

In summary, the investigators accepted not merely the collection of data or the development of a mathematical model as their responsibility, but rather the problem of putting in the hands of management—in a way that they would accept and in a form which they would use—a set of instruments that could make possible more effective decisions in the mining operation.

Editor's Note: For additional information on the value of Operations Research to International Minerals and Chemical Corp. see the following:

"Operations Research from the Operator's Point of View" presented at the American Institute of Mining and Metallurgical Engineers Convention, Chicago, Feb. 14, 1955 by H. T. Loehr of I. M. C.'s operating staff.

"Revolution in Control" by R. H. Ramsey. *E&MJ* April 1954, pp 72 to 77.

How Shop Practice Can Improve Tungsten-Carbide Bit Performance

THE FOLLOWING PRACTICAL operating experience with tungsten-carbide insert drilling equipment at the San Juancito property of the New York & Honduras Mining Co., Honduras, has been prepared from observations made during a trip in that area by J. Fred Johnson, well-known drilling expert and consultant of Salt Lake City.

Both chisel bits and cross bits were used in ⅞-in. quarter octagon and 1-in. quarter octagon straight carbon drill steel. Inserts were provided by Kennametal, Inc. At the outset alloy steel was not used because of a 16 months' supply of carbon steel on hand. Reduced steel consumption due to adoption of tungsten-carbide bits increased this inventory duration to an estimated four years.

Steel was upset in the drill sharpener with special dollies approximating the size and shape desired; then annealed in the line. The slots were milled on a lathe with ⅜-in. or 5/16-in. plain milling cutters, depending on the size of the insert to be used. The slot was about 0.003 in. oversize to make a loose fit for the insert. Slots and inserts were carefully cleaned with carbon tetrachloride and alcohol and coated with flux. The insert was then set in the slot and held in place by center punching on the top and ends of the slot. The same length insert was used for all three changes, the gage being regulated by different size buffer pieces between inserts. The water hole was maintained in the center of the bit for four-wing cross bits, but a side hole was drilled for chisel bits.

Silver-Rod Brazing

Brazing was done in a charcoal burning forge and in a furnace heated with producer gas. Best brazing results were obtained with a silver brazing rod with a melting point of 1,250 deg F, and a flow point of 1400 deg F. After brazing, the rod was air cooled. Excessive silver solder and bit irregularities were reduced by grinding. Steel sets consisted of three changes with a 1/16-in. gage differential.

During drilling, occasional shank breakage took place 2 to 4 in. behind the bit. In these cases the shanks were reforged, inserts recovered and installed in the reforged shanks. Some inserts shattered, usually during the first two or three drilling shifts. If the inserts survived more than three or four drilling shifts they rarely failed thereafter until being worn out.

In hard dense andesite with 3⅛-in. piston drills, footage per rod averaged 350 ft. In the same rock with a 2½-in. drill, footage was about 500 ft. The average for 100 rock drills in all kinds of rock was about 600 ft of hole per insert rod.

With 2½-in. machine shank breakage for ⅞-in. and 1-in. steel ran about the same. But for 3⅛-in. machines, the breakage of the smaller diameter steel was about 50% greater than for 1-in. steel. Adoption of tungsten carbide inserts cut steel costs to about 30% of that for forged bits. Taking into account the cost of inserts, overall saving was about 20%. Adoption of tungsten-carbide drilling enabled the mine to dispense with about 50 nippers, and to reduce steel sharpening work by about 50%.

Fewer rounds were missed as a result of adoption of tungsten carbide drilling, and miners showed great appreciation for the increased drilling speed experienced.

Later Improvements

The following data based on experience subsequent to the initial trial of tungsten-carbide equipment, outline later shop procedures at Rosario:

1. Steel was upset as before. Both cross bits and Carr bits were used.

2. Slots were milled to 0.013 in. oversize.

3. Steel was placed in a gas flame to burn off or vaporize all oil that entered the hole in the steel during milling.

4. Steel and inserts were cleaned with alcohol and carbon tetrachloride.

5. Inserts were wrapped in strip brazing alloy. Silver brazing alloy was provided in strips 0.003-in. thick. Three thicknesses were used in the bottom of the slot and one on the sides. Shims were placed between the inserts. Inserts were held in place by a soft iron wire wrapped about the bit.

6. The steel was placed in a vertical rack allowing the bit to project into a drill sharpening furnace mounted about 7½ ft above the shop floor. The steel was heated about two minutes at a temperature not exceeding 1,350 deg F.

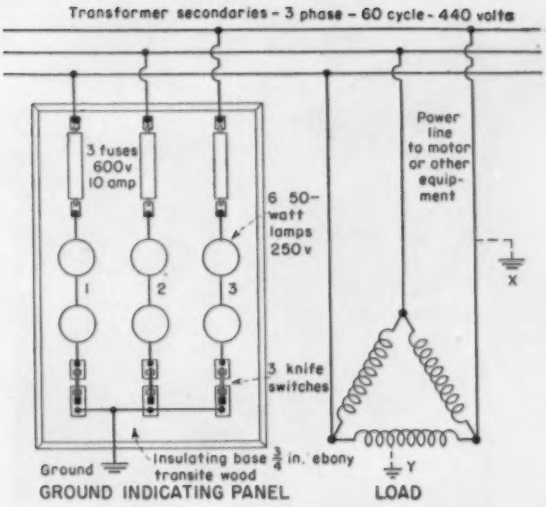
7. Steel was removed from the furnace and the brazing "topped off" by passing a strip of brazing alloy around edges of the inserts. Strips measured 5 in. long by 1 in. wide.

8. A tin can was placed over the bit, and the steel was allowed to cool in air.

9. Dressing the bit completed the operation.

Step 3, above, in which all oil was burned off, reduced insert breakage on all new inserts to less than 1%. It is believed that this operation prevented the formation of gas bubbles in the brazing alloy caused by oil fumes escaping from the hole in the steel. The furnace was mounted high above the floor (Step 6) to keep noxious fumes from fluoride fluxes away from the operators.

(Editors Note: This completes available data supplied to Mr. Johnson before the recent shut-down of the Rosario operations.)



Ground Indicator for Plant Power Systems

A GROUND in the electrical power system of a mine or smelter plant can be indicated effectively with the simple device illustrated here. It was installed at a large western copper smelter after serious power interruption in the roasting department of the smelter was followed by a second ground of 440-v secondaries of transformers supplying plant power. Success of the first installation was so pronounced that protective ground detectors were soon placed in other power centers in the plant.

The ac power system of this smelter included 2300-v, 3-phase generators at the central power house, metal clad switchgear, 3-phase distribution of 2300-v current and power centers at strategic points throughout the plant. Secondary distributors are 440-v, 3-phase, 60-cycle.

Most of the load of the low-voltage secondaries consists of squirrel-cage induction motors ranging from ¼ to 150 hp. Larger induction motors from 200 to 500 hp are also installed, but these are on the 2300-v lines. Several large 2300-v synchronous motors are used for power-factor correction.

What Happens When A Ground Occurs

When a ground develops, the indicator locates and clears the fault from the system as soon as possible. This is vital to forestall development of a second fault on the same transformer secondaries which would be equivalent to a short circuit, and interrupt the power service.

Most electrical failures in industrial ac power systems are due to insulation failures to ground. Therefore detection and rigid clearance from the system are vital.

The first ground is cleared by a process of elimination. Motors or other equipment connected to the 440-v secondaries are shut down successively and the disconnect switch for each load is opened just long enough to see if ground indications disappear at the detector.

Examples of Protection

1. An indicated ground was located in an underground conduit supplying power to a blower on a large steam superheater. Shut-down of this motor would have stopped the superheater. To avoid this, a temporary line was installed to replace the defective line. The blower was then shut down for 10 min while the underground line was put out of service and the temporary line connected. The blower was then put back in service. This brief stoppage did not affect operation of the plant. The faulty conduit was then repaired, and after another 10-min shut-down, the permanent line was connected to the motor.

2. An indicated ground was traced to a 40-hp vertical pump motor in the acid plant of the smelter. The ground showed up on the indicators when the motor was first put into service. As a result, a fault was discovered in the four-wire receptacle and plug at the motor station. This was quickly repaired.

3. On another new installation, a ground was indicated immediately on starting up a mixing tank. The trouble was located in the terminal box of a small motor driving the mixing tank. Since the operation of this motor was periodic, the fault indication was also periodic and enabled the operators to trace the fault easily.

4. In the roaster department a curve-drawing voltmeter is used to record the number of times a motor-driven dust conveyor is operated during the shift. The voltmeter leads are connected, through suitable fuses, directly to the motor terminals. An indicated ground was traced to a wooden mounting block inside the voltmeter which had charred and leaked to ground through an accumulation of moisture and metallic dust.

5. The detector on one bank of transformers indicated a fault which was quickly traced to windings of a 30-hp gearmotor driving a conveyor delivering concentrates from mill to smelter. Inspection revealed that the defect was not serious. Accordingly a spare motor was brought in, and operation of the defective motor continued until a substitution could be made conveniently.

Several new power centers at this plant, made necessary by extensive additions and improvements, use four-wire distribution systems with grounded neutral. With this type of secondary distribution, ground indicators are not applicable. Since one wire of the three-phase four-wire system is solidly connected to ground at the time of installation, development of an accidental ground at any other point on the distribution system, such as insulation failure in any motor, means a power service failure.

This survey should not be considered an argument for or against either of these two distribution systems. The article is merely a factual account of actual operating experiences, over a period of years, with low voltage systems employing three-wire distribution, with no part of the system intentionally grounded. However, it is quite pertinent to point out that with the grounded neutral systems, as used in the later additions to this plan, no period of grace is possible. Development of the first accidental ground inevitably means a power service failure.

Another interesting feature of these indicators is that they actually function as watchdogs on bearing wear. If bearing inspection and checking are neglected or if bearing lubrication fails to function as intended, the rotor of an induction motor will eventually begin to rub on the stator. Sooner or later this rubbing will cause displacement of the stator laminations. This displacement will, in turn, cause the relatively sharp edge of a lamination to cut through slot and coil insulation resulting in a grounded winding. The indicators will immediately detect this fault. If the motor is then taken out of service as soon as the necessary arrangements can be made, only minor repairs will be needed to put the windings in good condition.

Editor's Note: EM&J *is indebted to Thomas F. Jordan of Salt Lake City, Utah, who submitted this useful operating article shortly before his death in October last year.*

IN PRODUCTION SINCE 1954, Skyrme pit is producing 3,000 tons per day from easterly extension of one of Kelley ore zones. Stripping of another experimental pit, also in progress, may result in even larger open pit operations at Butte.

Anaconda Changes Mining Techniques As Butte Output and Reserves Climb

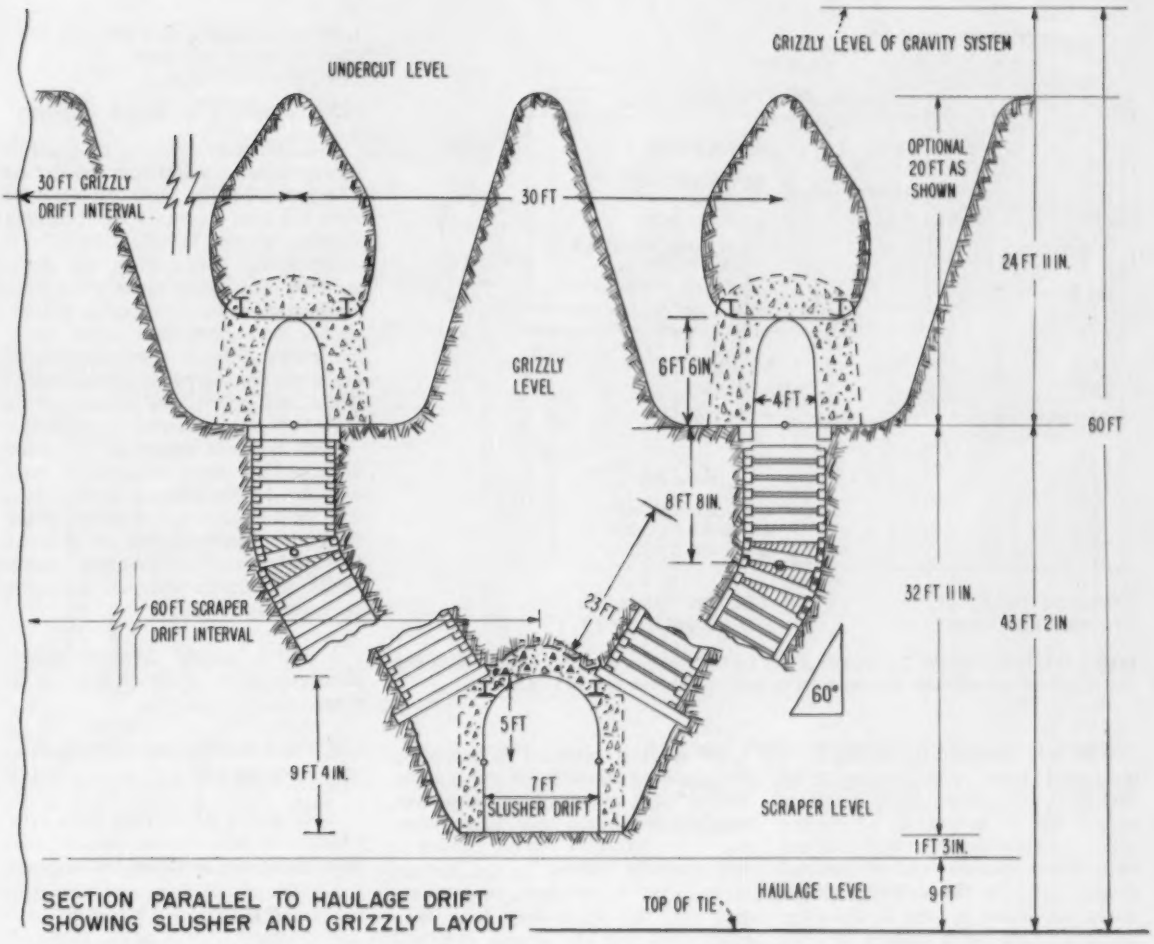
- **Auxiliary shaft boosts Kelley mine production**
- **One open pit adds to output; another is considered**
- **Cut-and-fill replaces square sets in highgrade ore**
- **Slushers and concrete improve block-caving**

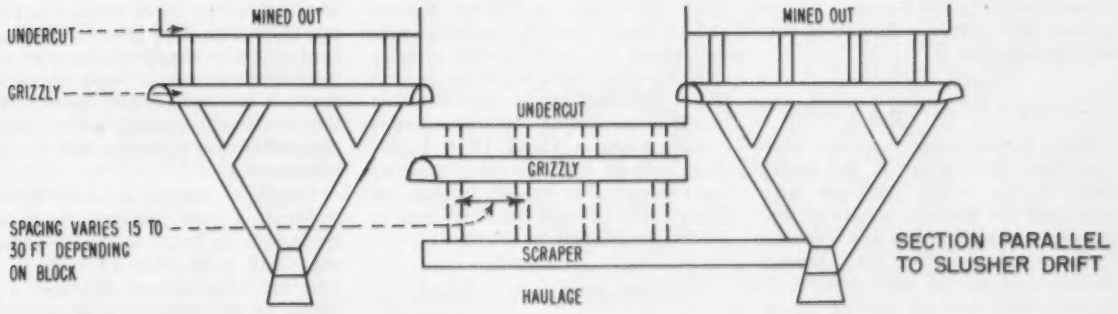
TO ONE VISITING BUTTE TODAY, the changed surface of the eastern part of famous Butte Hill and the spirit of optimism and confidence-in-the-future on the part of the people are indeed impressive. This is the outgrowth of the Greater Butte Project launched by Anaconda Co. in April 1948 with the sinking of the Kelley shaft and of the recent development of additional large tonnages of low-grade copper ore within the confines of the Project proper and in areas south and east of it. The latter event has extended the life of the "richest hill on earth" for many decades. Since start of production in April 1952, an ever-increasing stream of ore has been hoisted through the Kelley shaft for conversion into metallic copper for industry and the nation's stockpile, bringing with it steady employment and tax revenues for city, state and federal governments. Heavy subsidence in areas where underground block caving is in progress attest to the large tonnages removed during the 3-year production period.

Kelley mine production during the past year and up to completion of the new auxiliary shaft averaged slightly more than 12,000 tpd (with peak periods up to 13,900 tons) and the objective of 15,000 tpd was reached in July. In the Greater Butte Project mining area recent development work led to opening up an additional 30-million tons of ore, raising the previously estimated total tonnage from 130-million to 160-million tons.

About 3,000 tons a day are being mined by open pit methods from an easterly extension of one of the Kelley ore zones. The operation is known as the Skyrme pit and has been in production since the last half of 1954.

A new development that eventually may lead to the establishment of large open pit operations is the comprehensive exploration carried out for some



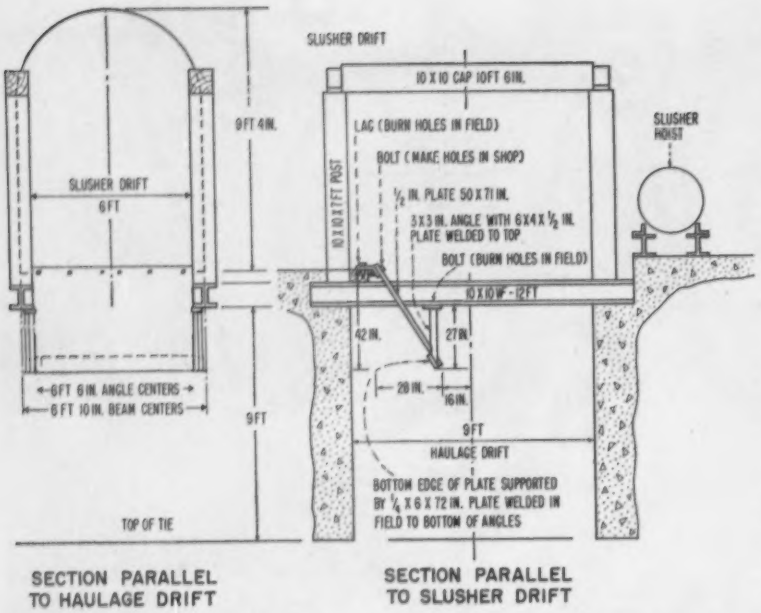


DEVELOPMENT REQUIREMENTS ARE LOWERED and production is raised by change from straight gravity system to one using slushers. Drifts are concreted, raises cribbed. Buckets, 56 or 60 in. wide, are pulled by 50 hp electric hoists.

time within the extensive near-surface, low-grade ore zone lying to the south and east of the Kelley mine mentioned previously. Some 46,550 ft of churn drilling was done in this area during 1954 indicating a potential ore reserve of about 100-million tons. Stripping of overburden is now in progress in preparation for an experimental open pit operation. This work, as well as that carried on in the Skyrme pit, is done under contract by a contracting company of Butte. The operations follow standard practice with benches in both projects carried at a height of 50 ft, which may be altered later to 25 ft.

Cut and Fill Enters Scheme

In the deep high-grade areas mined through the Mt. Con and other shafts a cut-and-fill method, replacing the square-set stoping formerly used, is giving good results cost and production-wise. The veins mined below the 4,200-ft horizon are somewhat narrow. Scheme is to drive raises at 150-ft intervals, breaking an 8-ft horizontal thickness of vein for a distance of 75 ft alternately on either side of the raise, scraping broken ore into raise and finally filling the void up to new operating floor with mill tailings.


SLUSHER DRIFT
10 X 10 CAP 10FT 6IN.
LAG (BURN HOLES IN FIELD)
BOLT (MAKE HOLES IN SHOP)
½ IN. PLATE 50 X 71 IN.
3 X 3 IN. ANGLE WITH 6X4 X ½ IN. PLATE WELDED TO TOP
BOLT (BURN HOLES IN FIELD)
10 X 10 W - 12 FT
SLUSHER HOIST
9FT 4IN.
SLUSHER DRIFT
6FT
10 X 10 X 7FT POST
42 IN.
27 IN.
28 IN.
16 IN.
6FT 6 IN. ANGLE CENTERS
6 FT 10 IN. BEAM CENTERS
9FT
9FT
HAULAGE DRIFT
BOTTOM EDGE OF PLATE SUPPORTED BY ¼ X 6 X 72 IN. PLATE WELDED IN FIELD TO BOTTOM OF ANGLES
TOP OF TIE
SECTION PARALLEL TO HAULAGE DRIFT
SECTION PARALLEL TO SLUSHER DRIFT

FOR LOADING CARS AT HAULAGE LEVEL use is made of simple slide-like chute. An average of three trips of bucket will load two 115-cu ft cars.

The slash is advanced by drilling 11-ft horizontal holes with jackleg drills and steel rods fitted with tungsten-carbide bits, an average of 9 holes per round, and blasting them with DuPont 30% Gelex powder and millisecond delays. Save for the cribbing in the raises, no timber is used in the stope areas, the roof being secured by rock bolts immediately after each blast. It is estimated that the method has resulted in a substantial saving in cost per ton and a large reduction in timber consumption.

Changes In Kelley Hoisting

Many improvements and new additions have been made in the Kelley mine. At the Kelley shaft the large cage used for lowering men and supplies has been removed and installed in the near-by auxiliary shaft and installation of special steel dividers to provide two hoisting compartments has been completed. The dividers are of telescopic design and are hooked into the guide anchors that formerly held the cage guide. Two "Long Tom" decks, long open cages with extension shoes, are used to do the job. Installation of dividers proceeded from the collar of the shaft down.

In the shaft itself another section has been holed through recently—the one extending from the Stewart 3,000 level to the Kelley 2,000 level, a vertical lift of 559 ft. The shaft is now open for a distance of 2,736 ft, of which 1,983 ft is concreted. Development work nearing completion on the 1,300 level is centered in preparing the ore zone above it for the gravity-slusher block caving system tested successfully in the area under exploitation above the 600 level. All ore broken in this work is hoisted to the surface through the Rarus shaft. In conjunction with this work there have been established two ore storage bins and skip loading facilities in the Kelley shaft on the 1,400 level to serve the 1,300 level. Two additional sheaves and a slide chute connecting with the storage bin ahead of the primary crushing plant have been installed on the Kelley headframe. The dumping mechanism serving the new shaft compartments is about 12 ft higher than that of the adjoining hoisting compartments to permit transfer of dumped ore through the slide chute to the bin mentioned by gravity.

Auxiliary Shaft Added

The raising and concreting of the auxiliary shaft a short distance from the Kelley shaft was described by A. D. Rood in *E&MJ*, May 1955. The shaft is now in operation. Preparatory work included installation of a steel headframe, the large cage formerly used in the Kelley shaft, and a double-drum hoist with counterweight. Latter is a 2,250-hp Nordberg unit housed in the extension added recently to the Kelley hoist house. A visit to this building presents the rare sight of three giant hoists installed on a common center line. The shaft is now open for a distance of 2,166 ft, with 1,941 ft concreted. It is used for handling materials and men.

Use Slushers in Block Caving

In addition to measures designed to further improve ventilation and reduce dust hazards in the block caving areas there has been a gradual shift from the standard gravity block layout to one incorporating both gravity and slushing to provide better control and raise production from each block. Briefly, slusher drifts have been added below the grizzly drifts to speed the flow of ore to the loading points at the haulage levels. All grizzly and slusher drifts are now being concreted.

Both types of drifts are advanced with jackleg drills using alloy steel rods fitted with tungsten-carbide bits, with broken material removed either by Eimco RockerShovels or scrapers of semi-box and folding-blade design. Drifts are driven with the following principles in mind:

1. 100% muck disposal before commencement of concreting operations.

2. Rock bolt support where ground conditions permit.

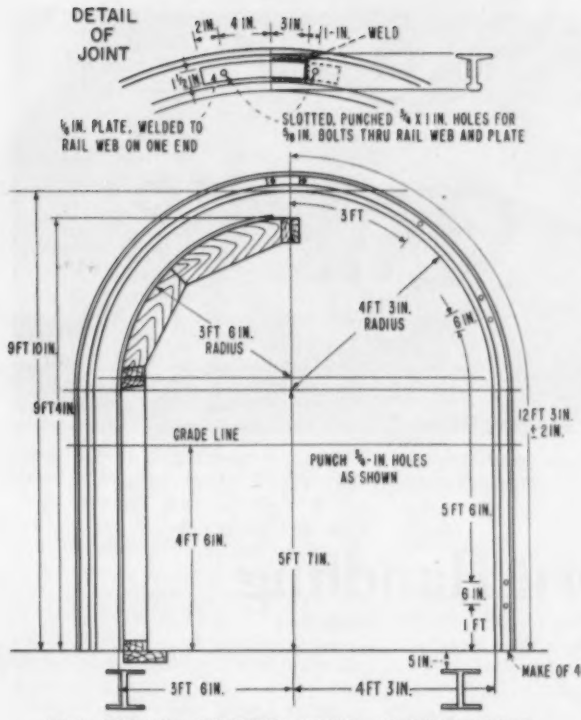
3. In places where rock bolts offer insufficient support use special steel sets. These can be concreted in place.

Change to Steel Concrete Forms

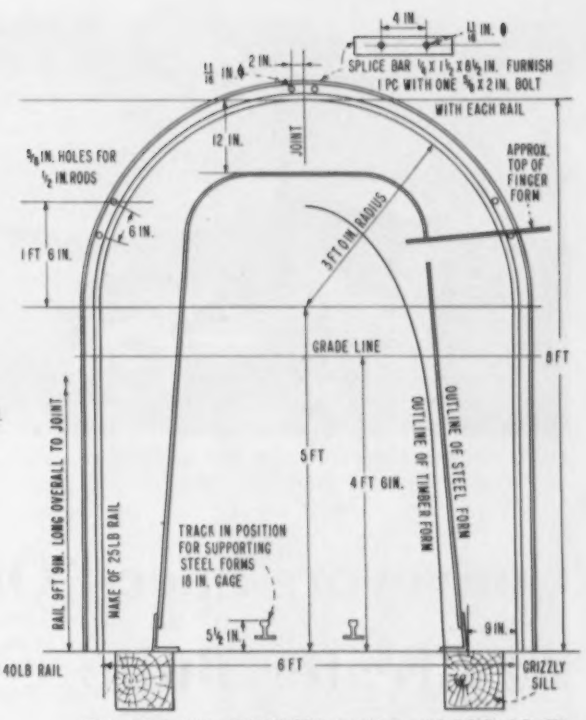
Until recently, prefabricated and sectionalized forms of wood construction have been used in concreting operations. It has been found that this type of form can be used about 20 times. A new type will be used shortly that is a track-mounted, sectionalized, collapsible, non-telescopic unit of steel construction.

Length of section is equal to the width of a raise opening. Pours are made equal in length to one raise spacing, which varies from 15 to 20 ft. A pour involving delivery of from 22 to 30 cu yd of concrete requires about 4 hours. The concrete is prepared in a central mixing plant and delivered to the respective pipe lines in the shaft by Ready-Mix trucks. From the discharge end of the pipes transfer to the working places is made either by Pumpcrete machine or pneumatic placer. The footage of concreting done per month when operating the mine on a 12,000 tpd production basis is 650 ft of grizzly drifts and 250 ft of slusher drifts, requiring about 1,500 ft of concrete. Cost of the concrete work is about equal to that of timbering.

In blocks where there is a slusher drift below the grizzly level produc-



RAIL SET AND CONCRETE LINING—SLUSHER DRIFT


4 IN.
SPLICE BAR ⅛ X 1½ X 8½ IN. FURNISH 1 PC WITH ONE ⅝ X 2 IN. BOLT WITH EACH RAIL
2 IN.
12 IN.
JOINT
⅝ IN. HOLES FOR ½ IN. RODS
APPROX. TOP OF FINGER FORM
6 IN.
1 FT 6 IN.
3FT 0 IN. RADIUS
GRADE LINE
8FT
RAIL 9FT 9IN. LONG OVERALL TO JOINT
MAKE OF 25LB RAIL
OUTLINE OF STEEL FORM
OUTLINE OF TIMBER FORM
5FT
4FT 6IN.
TRACK IN POSITION FOR SUPPORTING STEEL FORMS 18 IN. GAGE
5½ IN.
9 IN.
6FT
GRIZZLY SILL

RAIL SET AND CONCRETE LINING—GRIZZLY DRIFT

ROCK BOLTS ARE USED wherever ground permits; in other places steel sets are necessary. Both are concreted over. Pre-fabricated wooden forms are being replaced with track mounted steel ones. Cost of work is about equal to that of timbering.

tion per slusher drift is about 500 tons, with an objective of 750 tons. Scraper units employed in the slusher drift are driven by 50-hp electric tugger hoists. The bucket width is 56 and 60 in. On the average three scraper trips will load two mine cars, each capable of carrying 115 cu ft of ore. Adoption of the gravity-slusher block layout briefly described and shown in the accompanying illustrations and in operation in production areas above the 600 haulage levels and the 400 and 500 sublevels has brought about the following:

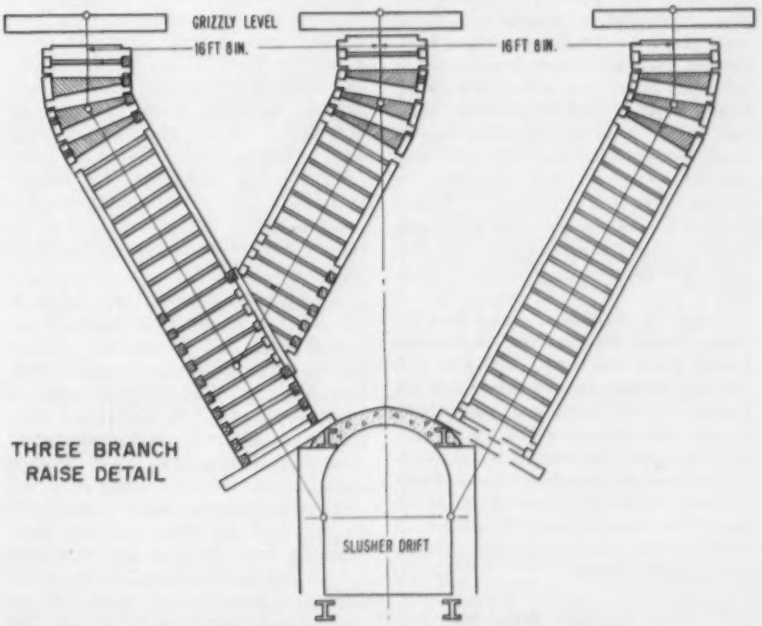
1. Eliminated long raises and chute and chute gates.

2. Provided larger grizzly openings with consequent higher tons per man-shift from 45 tons to 97 tons.

3. The area per drawpoints has been reduced from 300 sq ft to a minimum of 225 sq ft.

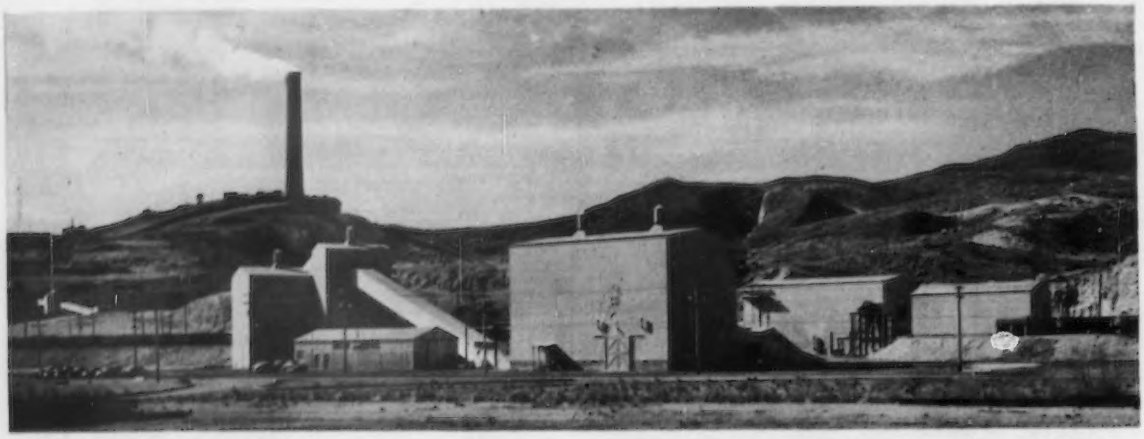
4. Concreting has reduced the active area per ton per day by about 25%. It has eliminated drift repairs.

To Chester H. Steele, vice president, Western Operations, Anaconda Co. thanks are due for permission to publish the aforegoing information. The help given and courtesies shown by members of the Kelley mine staff are gratefully acknowledged.



BETTER DRAW CONTROL results from use of three branch raise which reduces drawpoint area without adding grizzlies. Ground requires cribbing all raises.

Editor's Note: This article brings up to date the continuing development of Anaconda's Greater Butte Project. Since *E&MJ's* first news of plan in October 1947, articles have given: general scheme (Sept. 48), over-all plans (July 49), development plans (Oct. 51), operations (Apr. 53), leach-float plant (June 53), auxiliary Kelley Shaft (May 55), and crusher-conveyor system, designed to handle all this ore (elsewhere in this issue).



LOW-COST PUSH-BUTTON CONTROL moves the ore from car dumper, at right, through primary crusher, center, secondary crusher, at left, to the concentrator, 3850 ft away. System eliminated a 9 mile rail haul from the yard terminal.

Conveyors Speed Ore Handling At Greater Butte

WITH INCREASED TONNAGE COMING from the block-caving activities at Greater Butte, the Anaconda Co. has installed a new material handling and primary-secondary crushing plant at their East Anaconda property. Fast, low-cost transportation by conveyor belts has eliminated a 9-mile railroad haul from the yard to the concentrator; which, with its switching operations, frozen cars in winter and other attendant delays, was becoming a serious cost-of-concentration factor. Adequate crushing capacity and push-button control were designed into this plant that went into operation in May 1955.

Break-up of 100-car trains into 27-car trains in the yard has been eliminated. Now the ore is dumped, two cars at a time, by the Link-Belt car turner at the main rail yard. Next comes primary crushing, secondary crushing and the long haul by conveyor belts to the concentrator 3850-ft away. At its 2200 ton per hour capacity the plant will use 18 men, six of whom will be used in the concentrator and sample house.

Car Dumper Building

Like the others in the crushing plant, the building is a steel frame, asbestos panelled, windowless monolothic structure. It is served by a rail system of four parallel tracks, accommodating 80 loaded 55-ton cars at the receiving end of the tipple and two parallel tracks capable of holding 66 empties at the discharge end of the house. Switching and spotting is done by General Electric 65-ton, 370 hp diesel-electric locomotive. Operator in control room of car dumper building instructs engineer over Motorola radio system. Operator overlooks the track ahead of the tipple, the tipple itself and the pan conveyor system. Control room contains an automatic scale, manually-operated signal system used in event of radio failure and a telephone. All phones in the several plant buildings are separate from the general circuit to reduce outside interference to a minimum.

Revolving Link-Belt car tipple is one of the largest ever built. It accommodates and dumps two loaded cars at a time. Dumping speed is automatically controlled. Dumper is driven by 100 hp motor. Ore discharged from the cars is dumped into hopper-shaped steel bins below the tipple. Sloping sides of the bins are lined with A3 steel, reinforced by closely spaced 80-lb rail and the short vertical sides forming feed opening for pan conveyors are NiHard lined. Each of the Link-Belt pan feeders, with 100 hp motor and reduction gears, is 5-ft wide and 33-ft long, center to center, operating at 18 fpm and handling 1100 ton per hour. Feeders discharge onto two conveyor belts, known as No. 1 and No. 1A, leading to the primary crushers.

Near the discharge points in the primary crusher building two men to each belt remove wood and other foreign matter from the ore by hand picking. Waste from the belts goes into storage hopper alongside the belts and later by railroad to the nearby dump pile.

Primary Crushing Plant

Plus 6-in. ore brought to the plant by No. 1 and 1A conveyors is reduced to minus 5-in. by two Traylor 20-in. bottom discharge gyratory crushers. Ahead of these two crushers are two Allis-Chalmers 6x12-ft vibrating screens fitted with riffleflow grizzlies spaced 6 in. Oversize from the screens goes by gravity to the crushers, while undersize and the finished crusher product is diverted by conveyor belts No. 2 and 2A to conveyor 2B which discharges onto belt No. 3 leading to the secondary crusher plant. No. 3 has a Trans-Weigh scale, drawing dc current from a small generator driven by the return conveyor belt.

Dings magnets ahead of No. 3 conveyor are suspended from cables and can be lifted up through the floor above to discard tramp iron. Selenium power plant furnished dc power for magnets. Cables from generator are on reels and give or take cable as the magnets are raised or lowered.

Building also contains a Westinghouse control center for operation and protection of crushers and conveyors and a 50-ton Ederer crane to facilitate repairs. Capacity of this crane is large enough to lift a crusher from its foundation and transfer it to the repair bay.

Secondary Crushing Plant

Reduction to 1½-in., or mill feed, is accomplished in three standard 7-ft. Symons cone crushers, set 1-in., and driven by 225-hp motors. These operate in open circuit with three Allis-Chalmers 6x15-ft style C vibrating screens using decks with 1½-in. openings. Primary crusher products brought to the building by conveyor 3 are discharged into a 3-way splitter equipped with a swing gate arrangement that permits several combinations of flow, whence conveyors 4, 4A, and 4B direct it to the vibrating screens ahead of the crushers. Screen oversize goes to the cone crushers and the undersize and crusher discharge travel by belts 5, 5A, and 5B to conveyor 6 leading to the loading end of the long conveyor installation, operating between the secondary crushing plant and the storage bins ahead of the concentrator.

A 20-ton Ederer crane is available in the building to facilitate repairs on the crushers, screens, and other equipment. Operation of all machinery and belts is controlled from a Westinghouse control center similar in design as that in the primary crushing plant.

Incline Conveyors

Total lift from the secondary crushing plant to the edge of the concentrator building is 388 ft and requires about 3850 ft of conveyor carry, in 3 separate belts. Conveyors pass through tunnel sections totalling 2450 ft, with the remaining 1400 ft carried in steel-frame galleries sheathed with asbestos panels supported at set intervals by steel trestles. Junction buildings and splicing buildings serving the system are of similar construction. The tunnels were established by excavating trenches of predetermined size on proper grade; followed by placing precast concrete sections, each 6 ft long and connected by tongue-and-groove grouted seals, and the backfill. Air, telephone lines and power lines for equipment, lighting, control systems, and others are carried along the roof of each tunnel and in the galleries in special clamps resting in the slot of the steel caps set at intervals in the roofs. The tunnels are 8½x7-ft in cross-section.

First section of the conveyor system, with the secondary crushing plant as starting point, is conveyor 7. It is about 1699-ft long, on a slope of 4 deg. 07 min. 49.5 sec., and negotiates a rise of 115 ft. Conveyor 8 is 1164-ft long, on a slope of 6 deg. 41 min. 04.8 sec., with a rise of about 135-ft, and conveyor 9 has a length of about 987-ft, slope 8 deg. 04 min. 37.4 sec., and a rise of 138-ft.

From junction building No. 3, the end of conveyor No. 9, the material is transported and distributed to the storage bins by conveyor No. 10, 48 in. wide and 418½ ft long, and shuttle conveyor 10A, also 48 in wide and 345 ft long. When handling zinc ores, transfer from conveyor 10 to the storage bins ahead of the zinc crushing plant is done by shuttle conveyor 10A which can dump to conveyor 11. This unit is 48 in wide and 211 ft long. Two bins each hold 1500 tons zinc ore.

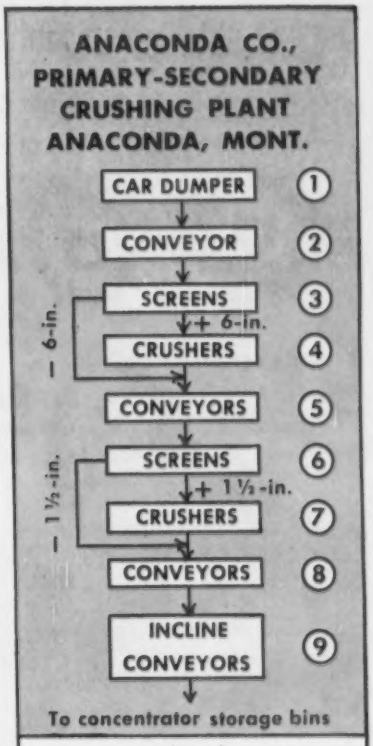
New sampling plant near the junction of Nos. 9 and 10 conveyor belts receives sample via a cross conveyor, with the rejects elevated and returned to the main belt over a second cross conveyor. Equipment contained in this plant and reduction of samples follow standard design and practice. Six men operate sampler and concentrator.

Safety Is Stressed

No expense has been spared by the management in making crushing and conveyor belt operations efficient, reliable, and safe. Westinghouse control centers of latest design are maintained at the primary and secondary crushing plants and concentrator. They employ the most advanced control and signal equipment. All belts are interlocked, have an accelerating period of 45 sec. average, and each is equipped with zero speed limit and alignment limit switches. In addition to telephone service, operators are warned of equipment failures by horn signals. All idlers supporting the belts at loading centers are faced with grooved rubber tires to cushion the extra weight on the moving belt at these points. Crushers are fully protected against overload and tramp iron by both electrical and oil pressure controls. Cables in the building are carried in Gripstrut flooring, affording easy access for repair and inspection.

Total capacity of the dust recovery system maintained throughout the plant and concentrator end is 197,000 cfm. Units are American Blower Co. cyclones. Installation serving the car dumper building handles 28,000 cfm; those at the primary and secondary crushing plants 28,000 and 42,000 cfm, respectively; and at junction buildings and other points 7,000 cfm.

E&MJ expresses its thanks to Chester H. Steele, vice president, Western Operations, the Anaconda Co., and W. E. Mitchell, manager, Anaconda reduction works, for permission to publish the aforegoing article and the many courtesies extended during the visit to the plants. The help given by C. A. Lemmon, assistant manager, and J. R. Moore, superintendent, in charge of the plants described is appreciated and acknowledged.



Legend

1. Two 55-ton cars are dumped at a time on Link-Belt car turner 100 hp motor
2. No. 1 conveyor. Hewitt-Robins 60-in., 8-ply belt moving at 135 fpm on 100 hp carries ore 228-ft on 12½ degree incline
3. Two Allis-Chalmers 6x12-ft vibrating screens with 6-in. spacing
4. Two Traylor 20-in. bottom discharge gyratory crushers. 225 hp motors. Product is minus 5-in. 50-ton Ederer crane for servicing crushers
5. No. 2 and 2-A Conveyors, Hewitt-Robins, 60-in. belt at 150 fpm on 15 hp, used for handling undersize around crushers
   No. 2-B, same size but at 500 fpm
   No. 3. Conveyor is 48-in. wide, 500 fpm on 250 hp. Trans-Weigh scale on No. 3
6. Three Allis-Chalmers 6x15-ft style C vibrating screens with 1½-in. openings
7. Three 7-ft Symons cone crushers set at 1-in. discharge. 20-ton Ederer crane
8. No. 4, 4-A and 4-B H-R conveyors are 60-in. belts at 150 fpm on 15 hp, to feed screens
   No. 5, 5-A and 5-B are same size but used for screen undersize and product feed to No. 6
   No. 6 is H-R 60-in. belt at 300 fpm on 25 hp
9. All incline conveyors are 7 ply, 48-in. belts by H-R and move at 500 fpm on 500 hp
   No. 7 is 1699-ft carry with 115-ft lift
   No. 8 is 1164-ft carry with 135-ft lift
   No. 9 is 987-ft carry with 138-ft lift
   Sample cutting station located here between No. 9 and 10 conveyors. Conveyors No. 10, 10-A and 11 feed appropriate storage bin at concentrator

What Applied Research Did for One Company

Before Research Program

PRODUCTION

Inerto Co., San Francisco, Calif., mined high grade bentonite clay from its Daggert mine. Lots of clay went to the dump pile since only the high grade, low calcite ore would sell.

MARKET

Slight tonnage sold to Tansul Co., who dried, ground and sold this high grade magnesium bentonite called hectorite to the brewery trade.

After Research Program

Through the applied research program conducted by Stanford Research Institute, Inerto Co. now refines run-of-mine clay, 60% hectorite, to a minus 10 micron 93-95% pure product. Production rate is 4,000 lb per day with recovery 90%. Flowsheet is relatively simple. Dump piles can be reclaimed. Ore reserves have increased.

The market survey section of the applied research program indicated that pure hectorite could be used as:

1. An effective high protein absorbent in beer stabilization.
2. An emulsifier and thickener for cosmetics and pharmaceuticals.
3. A body agent in latex paints.
4. Cracking catalyst in petroleum.
5. A mineralizer in basic refactories.
6. A lubricant in laundry starch.

How Applied Research Can Help

IS THIS THE ANSWER to our engineer shortage and our submarginal ore problems? Low budget research can pay dividends in more ways than one. Out of this research program came two flowsheets, and several new uses for the product; plus the fact that several young engineers got that extra year of graduate study. Not bad when you consider that the ore had little value before the program began. We have a whole skip load of submarginal ores, metals and minerals that could stand some applied research by our colleges and universities.

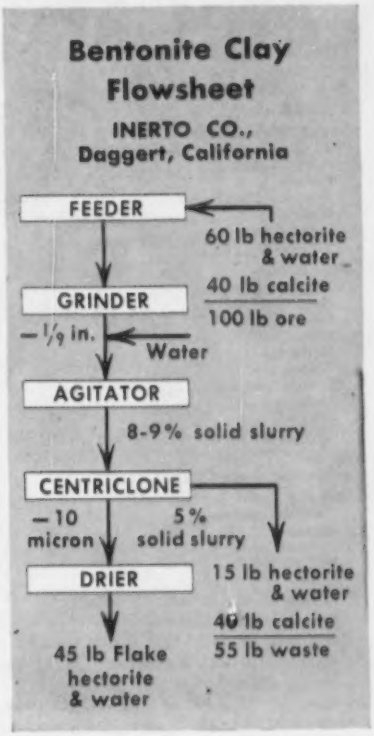
Cost of these programs could be kept down and the results can be significant. With more sponsored research we can keep our future engineers in school for that extra year or two of graduate study.

We've heard it said that one graduate engineer and four technicians can do more work and do it better than five undergraduate engineers can do. Some executives feel that this is the major cause of our present talent shortage . . . we're not short . . . we waste talent by using engineers where we need technicians and draftsmen.

Another suggestion has been offered. Industry should hire undergrads and send them through a year or two of graduate study before putting them to work. We wonder if the first suggestion isn't a better one. Send them there by applied research contracts. It's a tax deductible expense. It'll pay dividends in new ore processes, uses and talented engineers. Kill two birds with the same round. —Ed.

Properties of Pure Hectorite

1. Chemically hectorite is a magnesium substituted aluminum bentonite having the following typical chemical composition: SiO_2, 57.3%; MgO, 26.7%; CaO, 2.5%; Na_2O, 2.27%; LiO_2, 1.21%; R_2O_3, 0.62%; and loss on ignition, 6.0%
2. White wax-like solid having nearly 90% reflectance
3. Easily dispersed in hot or cold water
4. Thixotropic gel formation at 2-4% concentration
5. Prevents precipitation of finely divided whiting, barium and sulphate when used in 1-2% concentration
6. Will not disperse in hydrocarbon solvents or chlorinated organics
7. Can be dispersed on a flat smooth surface and dried to a uniform continuous layer. Film thickness down to 0.001 in. can be produced
8. Exhibits adsorption qualities for certain dyes and odors
9. Exhibits base-exchange, but not as active as zeolite
10. Will neither develop nor support bacterial growth
11. Inert, harmless and non-toxic when applied in reasonable quantities as an ingredient in cosmetics, pharmaceuticals and food.



Marginal Operators Mill and Market

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RECENT TECHNOLOGICAL ADVANCES gained through adequately planned research has made beneficiation of California's impure and "young" clay deposits economically feasible. Numerous western nonmetallic deposits once considered submarginal now can be made competitive with clays from "older" areas of the U. S. Inerto Co. contracted with Stanford Research Institute for an applied research program that has resulted in the marketing of almost pure hectorite clay.

Project covered the determination of pertinent mineralogical, chemical and physical properties, as well as the working out of a new and simple beneficiation process. With a new ore dressing method and the determination of the properties of the pure product, several new uses for hectorite came out of the seven months' program.

Two refining methods were developed. One method called for crushing, grinding, 5% solid slurry formation with fresh water, decanting the clay, converting the magnesium bentonite to an amine clay by ion-exchange, filtering, washing and drying. The dry amine clay is treated with caustic to convert the amine clay back to magnesium hectorite. Rather than get involved with ion-exchange, Inerto went to the pilot plant with the second method.

The second method, now in full scale production, called for treating 60% run-of-mine hectorite by grinding, 8-9% solid slurry formation using fresh water or dilute brine, centrifuging out the offending calcite and double drum drying to yield a product all minus 10 microns and 93-95% pure hectorite. Tailings from the process are almost pure calcite. More concentrated slurries can not be used; dilution is essential for good separation in the centriclone. Type and period of agitation during slurry formation are critical.

Pure hectorite turned out to be superior to the old high grade ore. So much so that 200 tons a year, under the trade name *Macaloid*, goes to the beer industry. Because of its specific adsorbent property for high molecular weight proteins, pure hectorite is an essential part of the *Tansul 7* beer process. Hectorite keeps the beer from clouding during chill-proofing stage.

Research at Stanford indicated that hectorite could be used as a binder and vehicle in pharmaceuticals and cosmetics. Better viscosity, better emulsification and inert nature made it superior to gums and organic materials. About 50 tons of hectorite per year go to the cosmetic and drug field. R. T. Vanderbilt Co., New York, buys ground ore from Inerto and produces 100 tons a year for the same use.

A third major outlet came about as a result of the research contract. Aircraft Marine Products Co., Harrisburg, Pa., buys ore from Inerto and produces about 200 tons a year for use in a dielectric sheet called *Amplifilm*.

Now under development is the use of hectorite as an additive to laundry starch. Its lubricating properties and its ability to disperse evenly appears to improve clothes ironing and prevent sticking.

Negotiations are underway between Inerto and F. W. Berk Co., London. Inerto would supply the ore and Berk would refine it for European markets.

Further experiments eliminated hectorite from consideration as a cracking catalyst and a refractory mineralizer due to its higher cost.

Table I. World Industrial Use of Copper

(Thousands of Short Tons)	Av 1913–14	Av 1915–18	Av 1919–21	Av 1922–24	Av 1925–29	Av 1930–35	Av 1936–39	Av 1940–45	Av 1946–50	1951	1952	1953	1954	Est. 1955	Est. 1960	Est. 1975
U. S. (incl. secondary,)....	437	959	588	681	953	574	757	1,525	1,422	1,497	1,574	1,573	1,367	1,500	1,600	2,000
Latin America.....	5	5	5	7	8	4	10	26	50	70	56	52	94			
British Commonwealth																
U. K. (incl. secondary from 1942).....	171	241	98	104	161	184	306	459	376	370	389	360	492			
Canada.....	24	48	36	13	18	31	55	128	101	134	130	109	103			
Australia-New Zealand..	13	13	8	9	10	7	17	74	23	36	39	29	42			
India.....	10	4	6	15	10	6	10	28	28	37	33	23	18			
South Africa.....	3	5	3	3	4	3	5	15	8	21	21	17	16			
Total Br. Comm.....	221	311	151	144	203	231	393	704	536	598	612	538	671			
West Europe																
Belgium.....	(1)	(1)	7	9	24	27	34		59	83	67	60	77			
France.....	104	165	63	121	129	118	124		120	125	156	118	161			
Germany-Austria.....	285	73	100	152	269	210	325		109	220	205	254	374			
Italy.....	30	69	34	48	72	66	89		56	70	70	78	97			
Netherlands.....	(1)	(1)	(1)	(1)	(1)	6	9	NA	13	16	12	18	58			
Scandinavia (2).....	(1)	(1)	15	16	22	37	60		84	69	75	55	87			
Spain-Portugal.....	1	7	8	8	16	12	13		14	8	13	9	20			
Switzerland.....	(1)	(1)	7	10	13	15	19		25	28	27	13	32			
Others.....	28	15	3	7	30	18	17		19	21	22	20	24			
Total W. Europe.....	448	329	237	371	575	509	690	e400	499	640	647	625	930			
Japan.....	28	45	85	77	85	100	201	e120	53	105	103	108	110			
Other Asia-ex Br. Comm...	9	3	5	16	11	5	9	15	2	...	2	3	3			
U. S. S. R. & Satellite States																
Czechoslovakia.....	(1)	(1)	7	11	17	18	34		16							
Hungary.....	(1)	(1)	(1)	(1)	(1)	8	14									
Poland.....	(1)	(1)	(1)	(1)	(1)	11	23		13	23	23	25	400			
U. S. S. R.....	47	61	4	9	41	65	172	e175	203	280	325	335				
Others.....	..	..	..	..	..	..	..	..	..	..	..	..	..			
Total U. S. S. R. etc..	47	61	11	20	58	102	243	e190	232	303	348	360	400			
Secondary not incl. above	139	195	221	245	227	230	228	187	255	100	82	118	108			
World total.....	1,334	1,908	1,303	1,561	2,120	1,755	2,531	e3,167	3,049	3,313	3,424	3,377	3,683	3,700	3,750	5,000

(1) Incl. in Other Europe. (2) Incl. Finland.

Table II. World Mine Production of Copper

(Thousands of Short Tons)	Av 1913–14	Av 1915–18	Av 1919–21	Av 1922–24	Av 1925–29	Av 1930–35	Av 1936–39	Av 1940–45	Av 1946–50	1951	1952	1953	1954	Est. 1955	Est. 1960	Est. 1975
U. S.....	597	916	502	672	887	391	680	959	780	938	933	949	836	950	900	900
Latin America																
Mexico.....	49	58	44	49	69	52	47	54	68	61	61	70	62			
Cuba.....	6	11	9	12	16	11	13	9	18	22	19	17	17			
Chile.....	48	92	87	184	273	227	375	511	438	420	446	400	401	476	476	
Peru.....	30	46	39	42	52	36	39	39	27	36	34	38	41	50	150	
Bolivia.....	..	..	9	9	7	3	4	7	6	5	5	5	4			
Other Lat. Amer.....	..	..	..	1	1	..	..	3	1	..	..	..	..			
Total Latin America..	133	207	188	297	418	329	478	623	558	544	565	530	525	539	639	800
British Commonwealth																
Canada-Newfoundland..	28	55	34	38	82	160	274	298	258	270	258	254	310	358		
Rhodesia-So. Africa.....	12	14	10	15	20	116	220	286	298	400	416	461	505	525	600	
Australia.....	46	44	23	17	13	17	23	26	17	18	22	38	41	41	50	
India-Burma.....	..	..	..	..	3	13	11	7	7	8	7	6	8			
Cyprus.....	..	..	..	..	2	6	30	3	17	25	30	24	22			
Total British Comm...	96	113	67	70	120	312	568	620	597	721	733	783	886	954	1,038	1,200
Africa-ex Brit. Comm.																
Belgian Congo.....	10	18	20	69	94	110	136	176	169	212	227	236	247			
Other Africa.....	..	..	..	..	..	..	..	..	1	2	2	2	2			
Total Africa-ex Br. Comm.....	10	18	20	69	94	110	136	176	170	214	229	238	249	253	253	300
Asia-ex Brit. Comm.																
Japan-Korea.....	75	103	74	65	75	80	88	72	30	47	59	64	73	90		
Philippines.....	..	..	..	..	..	..	3	6	5	14	15	14	16	27		
Other Asia-ex. Br. Comm.	..	1	1	2	1	1	4	5	4	5	5	5	e5			
Total Asia-ex Br. Comm.....	75	104	75	67	76	81	95	83	39	66	79	83	94	122	122	150
Europe-West																
Scandinavia.....	17	17	14	12	16	30	45	42	55	51	58	50	53			
Spain-Portugal.....	49	44	34	53	60	39	33	11	8	8	10	9	8			
West Germany (1).....	28	35	21	26	33	33	33	22	..	2	3	2	2			
Yugoslavia.....	6	7	3	7	15	37	45	26	41	40	41	39	35			
Turkey.....	..	..	..	..	..	..	3	11	12	19	25	26	28			
Other W. Europe.....	17	15	4	4	9	9	5	6	11	17	18	19	20			
Total West Europe...	117	118	76	102	133	148	164	118	127	137	155	145	146	150	140	130
U. S. S. R. & Satellites																
U. S. S. R.....	32	17	5	3	18	44	118	157	201	280	325	335				
East Germany.....	..	..	..	..	..	..	..	..	18	18	18	18	358			
China (2).....	..	..	..	..	..	..	..	..	4	5	5	5				
Others.....	..	..	..	..	..	..	..	1	..	..	..	..	..			
Total U. S. S. R. etc..	32	17	5	3	18	44	118	158	223	303	348	358	e358	358	358	400
World total mine production.....	1,060	1,493	933	1,280	1,746	1,415	2,239	2,737	2,494	2,923	3,042	3,085	3,099	3,401	3,525	3,580
Secondary production																
U. S.....	75	105	119	132	223	210	222	129	247	186	174	e240	e225	260	300	
Rest of World-est.....	139	195	221	245	227	230	228	241	459	345	323	346	350	350	400	
Total Secondary-est	214	300	340	377	450	440	450	370	706	531	497	586	575	610	700	1,000
World total production-est.....	1,274	1,793	1,273	1,657	2,196	1,855	2,689	3,107	3,200	3,454	3,539	3,671	3,674	4,011	4,225	4,580

(1) Total Germany prior to 1946. (2) Included in Other Asia prior to 1946.

The Price of Copper, 1955-1975

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PROSPECTIVE INDUSTRIAL REQUIREMENTS of copper, based on long term trends in evidence since 1912, are on the order of:

	1955	1960	1975
	(Thousands of Short Tons)		
U. S.	1,500	1,600	2,000
World	3,700	3,750	5,000

Government stockpiles probably will continue to require tonnages in addition to these for some time beyond 1955.

In 1954 the world produced 3,674,000 short tons of copper, of which 3,099,000 tons were derived from mine production and 575,000 tons (estimated) were derived from secondary sources. It is expected that mines and secondary sources of supply will be expanded in step with rising demand during the period 1956-1975.

Present sources of supply are adequate to meet present requirements, both industrial and stockpile. The long-term price of copper should average about 30.00c a pound with only temporary deviations therefrom. At this price level producers generally enjoy a good margin of profit.

The effect of continuing inflation at an unpredictable rate will, of course, be reflected in over-all production costs and consequently in market prices. For example, in the near future the effect of the "lay-off-pay" plan, accepted during 1955 in the automobile industry, and the extent to which it spreads to other industries has still to be measured.

See Table III for U. S. and world copper position.

Throughout this article the term "secondary copper" refers to unalloyed copper recovered from secondary material. A large tonnage (about 700,000 tons in the U.S. in 1953) is also contained in secondary brass, bronze and other copper-base alloys. This latter is not identifiable as copper, and is not included in the data in this article.

Throughout the period 1913-1954, annual figures for secondary copper have been published for the United States. For the rest of the world, production has been estimated for the years 1913-1945 on the basis that total industrial use provides the same percentage of recoverable copper as it does in the U. S. Since 1945 actual data on the use of secondary copper is available for U. K.

See Table IV showing future world requirements for copper.

An addition upwards of 25-million short tons to America's permanent reserve of copper is indicated, since 60-75% of copper used in industry is eventually recoverable for re-use.

The figures are of further interest because they show that during the period the United States, comprising 7% of the world's population, absorbed over 42% of the world's entire production of copper, including secondary copper. This points up an impending expansion of demand upon the world's copper resources as the other 93% of the world's population raises its standards of living and coincidently becomes more "copper-minded" than heretofore.

There is no doubt as to Russia's emergence as a formidably industrialized nation. China has announced long-term plans for development patterned along the lines of Russia's five-year plans. India and Indonesia both have ambitious industrial development programs under way. Among Latin American countries, Mexico, Brazil and Argentina are fostering both power development and industrialization.

All of these programs will require copper, and however humble their beginnings or slow their growth, their application to such a large proportion of the world's population indicates increasing requirements for the world's suppliers of copper to meet.

See Table V for analysis of world and U. S. Production 1913 to 1954.

During the first part of the period, before 1940, the U. S. accounted for about half of the world's total production and was not only the largest user of copper but also an important exporter.

During World War II, 1940-45, despite Government premium payments U. S. mines and secondary sources accounted for only about one-third of the world's production of copper. On the other hand, as the "arsenal of democracy," U. S. absorbed nearly 50% of the world's production. It was during these war years that U. S.'s position changed from that of tradi-

Table III. U. S. and World Copper Position

(Thousands of short tons)	U. S. 1954	U. S. 1955 Est.	U. S. 1960 Est.	World 1954	World 1955 Est.	World 1960 Est.
Production:						
Mine	841	950	900	3,099	3,326	3,450
Secondary	225	260	300	575	610	700
Total production	1,066	1,210	1,200	3,674	3,936	4,150
Net Imports	366	300	560	.....	.....	.....
Total Production and imports	1,432	1,510	1,760	3,674	3,936	4,150
Distribution:						
To Industrial use	1,367	1,500	1,600	3,601	3,700	3,750
To refinery stocks	42**	10‡	160‡	141**	236‡	400‡
To stockpile	180			180*		
Total distribution	1,505	1,510	1,760	3,640	3,936	4,150

*No provision is made for stockpiles other than that of U. S.
**Decrease.
‡Stocks and to stockpile combined.

Table IV. Future World Requirements of Copper

During the forty-two year period 1913–1954 inclusive, world production and use of copper have been about as follows:

	(Thousands of Short Tons) U. S.	World Outside U. S.	World Total
Production:			
Mine	31,191	50,755	81,946
Secondary	7,420	e10,988	18,408
Total production	38,611	61,743	100,354
Used in industry	42,025	56,083	98,108
To Government stockpile	e811		811
Unaccounted for		1,298	1,298
Increase in refinery stocks	decrease 6*	143	137
Total requirement	42,830	57,524	100,354

e Estimated. Of the total now in stockpile about 180,000 tons were acquired in 1954.

*Refinery Stocks 12/31/12	53 (visible)	39	92
12/31/54	47	182	229

Table V. World Production and U. S. Production and Absorption of Copper, 1913 to 1954

	World Production (Including Secondary) (Thousands of Short Tons)	U. S. Production	U. S. Absorption	Percent of World** Production
1913-39	51,495	25,586	19,754	38.4
1940-45	18,792	6,672	9,150	48.7
1946-54	30,336	9,616	13,908*	45.8

*Including stockpile. **Absorbed by U.S.

Table VI. Industrial Use of Copper for Various Countries

(Thousands of Short Tons)

	Average 1936–1939	1954
U. S.	757	1,367
U. S. S. R.	172	375
Latin America	10	94
Canada	55	103
South Africa	5	16
India	10	18
Western Europe	690	930

tional exporter on balance to that of importer in large volume. U. S. mine production failed by a wide margin to keep pace with the extraordinary expansion of U. S. copper requirements.

Since 1946, U. S. has accounted for 31.7% of world production but has absorbed (including stockpile) 45.8% of world production. U. S. mine and secondary production remained at about 1,100,000-1,200,000 short tons a year, while U. S. requirements (including stockpile) continued to rise.

Consumption of copper in peacetime ordinarily depends largely on the capital goods industries (plant and building construction, power and communication lines, railway and other heavy equipment, etc.) and on the durable consumer goods industries (automobiles, radio and television sets, refrigerators, etc,). In ordinary peacetime years only 5-10% of copper production is scheduled for immediate consumption uses such as kitchen utensils, safety razors, hair pins, jewelry and flashlight tubes.

During war time, a considerable portion of copper production flows into immediate consumption uses, e.g., ammunition and ordnance. Much of this copper is permanently lost through inevitable wastages of war, but a large part of it ultimately becomes recoverable as secondary material.

Industrial Needs Increase

World War II set in motion a worldwide industrial development of extraordinary scope. It may be noted by way of illustration that the industrial production index for the United States (Federal Reserve Board), which represents volume divorced from price, rose from an average of 100 during the pre-war period, 1936-1939, to 224 for the year 1954. This rapid expansion has been paralleled more or less in other countries. See Table VI for industrial use of copper.

Industrial use of copper in Western Europe remained below pre-war until 1954. During 1954, especially the last half of the year, demand for copper in Europe increased. This was due in part to shipment of fabricated copper products from Western European countries to countries behind the Iron Curtain. To this must be added the impact of the prospect of German rearmament, since established in fact, which requires copper for weapons and war materials, plants to manufacture them, and the power facilities to service the plants. Over and above these considerations, however, is the fact of economic revival of Western Europe, not only in Germany and U. K., but also in France, Belgium and The Netherlands.

In France, for example, industrial production increased 10% during 1954 as compared with 1953. Currently, France's industrial machine is expanding while operating at near capacity. French automobile and electrical industries are flourishing and the population of France, like other Western European populations, is beginning to appreciate modern conveniences budgeted on monthly payment plans. France's 1955 industrial output is expected to exceed that of 1954.

From the end of World War II up to the end of 1954, U. S. industry invested about $300-billion in capital goods, of which $36-billion was invested during 1954. During the next five years, that is up to the end of 1959, it is expected that an additional $200-billion will be so invested.

During the war, plant and equipment were expanded by only about enough to take care of actual production of munitions. But over-all production increased greatly during the war and available plant and equipment were utilized far beyond normal capacity. Thus, by 1946, replacement needs were very high. At the same time the much higher rate of production in post-war years, as compared with pre-war, called for rapid expansion of capacity.

Further, certain new industries, such as air-conditioning, have required in large volume their own particular types of plant and equipment. Copper has also been required for added power facilities, plants, generators, transmission lines, etc., to take care of accelerated industrial activity plus coincidental increase in general living standards. "Americans are using three times as much light today as ten years ago" (E. W. Briggs, Westinghouse Electric Corp., 9/17/54). Americans are also using household appliances—vacuum cleaners, air conditioners, refrigerators, deep freezers, television sets—on a scale undreamed of ten years ago.

For the immediate future, this rapid rate of expansion of U. S. industrial capacity is expected to continue. Indeed most of the new industries, e.g., air conditioning and television, are still in the stages of early rapid growth. And by 1959, it is estimated, about 28% of such units produced between 1946 and 1949 and 9% of those produced between 1950 and 1954 will be replaced by newer equipment. The U. S. corporate tax rate on net income offers tangible inducement to the setting up of heavy future depreciation charges against new plant and equipment, especially when it also can be demonstrated that the new plant and equipment of themselves are far more productive than the old.

Capital Goods Are the Key

Such are the present prospects in the U. S. for the capital goods industries and, ipso facto, for copper. The word "present," however, needs underscoring. Any dimming of the current rosy outlook for future business expansion would be reflected very quickly in the capital goods section of general industry. In the past, capital outlays have usually contributed largely to major swings in the business cycle, and they have also (usually) fallen much deeper and risen much higher (ratiowise) than the national output. The present prospects, however, seem exceptionally favorable.

On Chart I are shown the annual industrial use of copper in U. S. (1900 to 1954) and throughout the world (1913 to 1954) together with the long-term trend lines in evidence for each. Projection of these trends into the future indicates for the U. S. annual use of copper of about 2-million short tons by 1975 (1,367,000 tons in 1954) and for the world a total of about

5-million short tons by 1975 (3,683,000 tons in 1954). Both figures include secondary copper. These projections are not intended to serve as estimates of the amounts of copper that will be required in any one year between now and 1975, but to point out, rather broadly, the central lines about which annual data may be expected to fluctuate. See Table VII for estimated World and U. S. industrial use of copper.

In addition to copper going to industrial uses, U. S. is acquiring (1954-1955) between 100,000 and 200,000 tons of copper a year for Government stockpile. It is problematical how long such acquisition will be continued, and at what rate. By the close of 1954, the stockpile contained 811,000 tons (estimated) of which about 180,000 tons were acquired during 1954. The Government has several contracts, both actual and contingent, for deliveries in the future, of copper from U. S. deposits now in production or being developed.

During 1954 and 1955 it has been demonstrated that the ultimate purposes of stockpiles can be broadened to include more than mere emergency reserves of an essential commodity. Early in 1954, the U. S. by purchasing for stockpile 100,000 tons of copper from Chile helped to relieve a world condition of over-supply which seemed to threaten the stability of world copper prices. Later in 1954 the U. S. Government helped to relieve a growing shortage of copper by diverting to industrial use about 42,000 tons scheduled for delivery to stockpile. During 1955 U. S. diverted to industrial use a further substantial quantity scheduled for stockpile. (The British Government, in 1955, actually sold from its stockpile to industrial users some 73,000 short tons of copper to help relieve a shortage occasioned by strikes in Rhodesia).

Impact of Stockpiling

It is not possible, therefore, to estimate at what rate stockpiles will continue to take metal off the market. The U. S. might continue to acquire, say, 10,000 tons a month, or 120,000 tons a year. Other governments may have similar plans. To whatever extent stockpiles draw from available supplies they will exercise a firming effect on price. To the extent that they make copper available to relieve shortages of supplies they can act as a strong deterrent to too rapid rises in price

On Table I is shown by countries the world's industrial use of copper by periods from 1913-1954 together with estimates for 1955 and 1960.

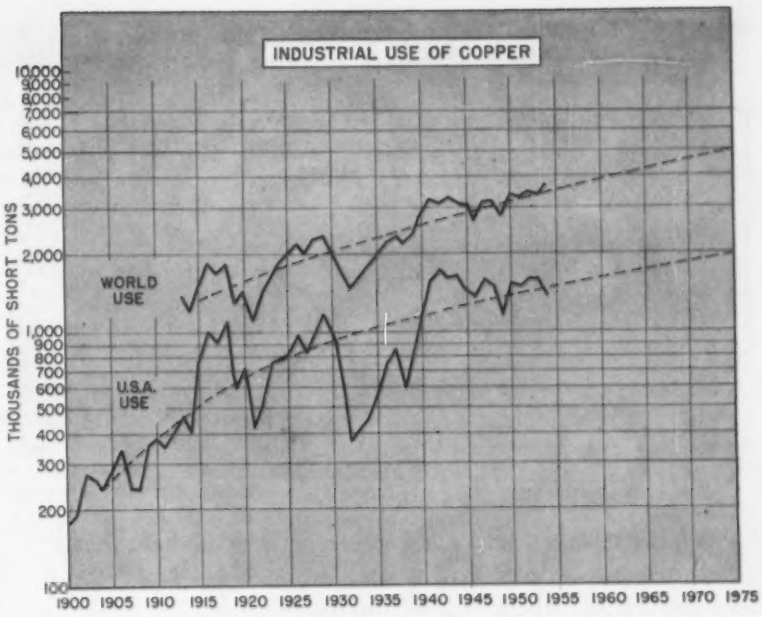


CHART I. Industrial use of copper in the U.S.

Table VII. Estimated Industrial Use of Copper 1954—1960

(Thousands of Short Tons)

	U. S.			World		
	New	Secondary	Total	New	Secondary	Total
1954	1,142	225	1,367	3,108	575	3,683
1955	1,240	260	1,500	3,090	610	3,700
1956	1,252	268	1,520	3,100	628	3,728
1957	1,264	276	1,540	3,100	630	3,730
1958	1,276	284	1,560	3,076	664	3,740
1959	1,288	292	1,580	3,063	682	3,745
1960	1,300	300	1,600	3,050	700	3,750

These figures include secondary copper, actual for U. S., estimated for countries outside U. S. The estimated world total shown for 1960 is 3,750,000 tons which includes 700,000 tons of secondary copper. Referring again to Chart I, note that the trend line shown and used as the basis for the above estimate is a projection of the trend actually in evidence from 1913-1954. However, other than trend lines, in support of such estimate of future industrial demand, there may be cited substantial supporting opinion. For example, on February 16, 1955, president A. B. Homer of Bethlehem Steel Co. stated that Bethlehem economists expect a gross national product—the sum of all goods and services produced—of about $425-billion a year for the five years 1958-1962, and an annual average of $575-billion for 1968-1972. The figure was $357-billion in 1954. President Homer also prognosticated average steel production of about 118-million tons for the 1958-1962 period and about 145-million tons fifteen years from now. This would compare with an average figure of 92,400,000 tons in the period 1948-1952. President Homer assumed a rise in the population of the United States to 200-million by 1970 from its present figure of 162-million.

World Supplies

On Table II is shown the world's mine production of copper by countries from 1913 to 1954, together with estimates for 1955 and 1960. The entire period of 42 years is divided into significant sub-periods, as follows:

1913–1914	Pre-War I
1915–1918	War I
1919–1921	Post War I Depression
1922–1924	Recovery
1925–1929	Boom
1930–1935	Depression
1936–1939	Pre-War II
1940–1945	War II
1946–1950	Interbellum
1951 and following	Korea and "Cold War"

To meet the world's demand for copper, the mines of the world have

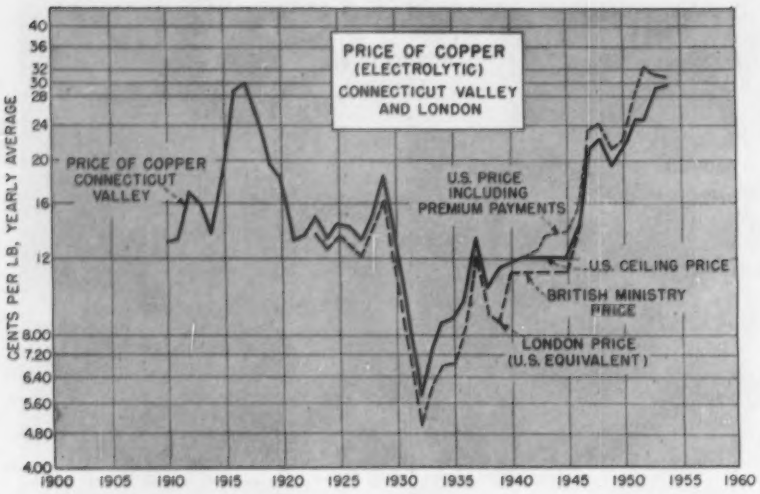


CHART II. Price of electrolytic copper London and Connecticut Valley.

just about tripled production during the period shown. The most noteworthy increases having come from:

Increase in Annual Rate of Mine Production During 42 Years
(Thousands of Short Tons)

Rhodesia	493
U. S. S. R & Satellites	326
Chile	277
Canada	272
Belgian Congo	241
U. S.	239

These six countries have accounted for 1,850,000 of the 2,000,000 tons of increase in copper mine production.

U. S. mine production attained an all time peak in 1943 at 1,114,000 tons but in 1954 stood at 841,000 tons. Chilean mine production reached 549,000 tons in 1944 but subsequently declined to 401,000 tons in 1954, production having been much curtailed by labor troubles. Canada attained a peak mine production of 338,000 tons in 1940 as compared with 310,000 tons in 1954 when it too was reduced by labor trouble. Except for Scandinavia and Yugoslavia, Western Europe production has been on a downward trend for many years. Thus, although total world mine production registered a high of 3,099,000 tons in 1954, the general outlook would have been for a static or gradually declining volume of mine production in future years in face of rising demand were it not for certain developments set in motion during the past three or four years.

New projects for expansion of copper supplies began to come into production in 1952. Some are still in development and some still in the prospect stage. Their total is expected to approximate, in terms of annual production, about 700,000 tons by 1960. Some of this new production will be offset by continuing depletion of older orebodies, but the net gain to the world should be not less than 400,000 tons a year, namely from 3,042,000 tons in 1952 to about 3,450,000 tons in 1960. See Table VIII showing copper expected from new developments and Table IX showing balance of prospective supply and demand.

Out of this balance of production over industrial requirements, are drawn the tonnages required for stockpile. It may be seen that the close balance between industrial requirements and new supplies during 1954 allowed little margin for stockpile requirements which had to be provided by withdrawals from industrial stocks.

Impact of Strikes

The tight situation prevailing during the latter quarter of 1954 and the first half of 1955 stems from interruptions in mine production schedules occasioned by serious strikes in U. S., Chile and Rhodesia at the same time that industrial demand was increasing sharply. Barring further strikes, it is likely that during 1955 equilibrium will be re-established as between supply and industrial demand, at the same time leaving a balance to provide for stockpile requirements, and a start toward restoration of depleted world refinery stocks. These stocks were reduced from 406,000 tons at the end of March 1954 to 201,000 tons at the end of April 1955.

Between 1955 and 1960, it is likely that supply of new copper will tend to exceed both industrial and Government requirements. For the period 1960-1975, present sources of supply seem inadequate for rising industrial requirements throughout the world. New sources must be developed.

The Price of Copper

The last quarter of 1954 and the first quarter of 1955 was a period of active world-wide industrial demand for copper in face of dwindling available stocks. The U. S. Connecticut Valley price rose from 30.00c a pound at the beginning of 1955 to 36.00c a pound, an increase of 20% in three months. The London Metal Exchange price (cash) rose from an average of 29.50c a pound (U. S. equivalent) in August 1954 to an average of 44.06c a pound in March 1955, an increase of nearly 50%.

Once equilibrium between demand and supply is restored, as seems probable in the near future, there is little apparent reason for not expecting the U. S. and world prices of copper to revert to a level of about 30.00c per pound. At this level, before the squeeze, copper producers generally enjoyed a satisfactory profit margin per pound of copper sold. Available (May 1955) annual company reports for 1954 indicate over-all costs as shown in Table X.

Chart II presents on an annual average basis the price per pound of copper in U. S. (1910-1955) and at London (1923-1955).

30c Price Is Indicated

It is probable that the price of copper will remain at about the 30.00c level during the period 1956-1960 with only minor variations therefrom. There may be strikes in the producing areas, but it may be hoped that there will not again occur the coincidence of three such major upsets in close succession—U. S., Chile, Rhodesia—as distinguished 1954-1955.

Beyond 1960 the long-term price of copper will depend on how adequately sources of supply are expanded to meet rising demand. A too rapid expansion of supplies would entail declining prices for copper; a laggard expansion of supplies might again occasion rising prices or substitution of other materials in certain of copper's present uses or both. Based on present prospects for both demand and supply a reasonable expectation would seem to be a long-term price level of 30.00c a pound.

On Chart III there is shown a combination of the Index of Industrial Production (Federal Reserve Board)

Table VIII. Copper Production Increases Expected from New Developments

Of the 700,000 ton increase expected by 1960 from new projects in the development and prospect stage, the following are still in prospect:

	(Thousands of Short Tons)				
	1955	1956	1957	1958	1959
U. S.	98	70			
Canada	48	(Also Granduc deposit in prospect)			
Peru				100	
Chile	75				
Rhodesia		59		24	9
Philippines	15				
Australia		11			
Sweden	(High-content orebodies in Adak district)				

Table IX. Balance of Prospective Supply and Demand

(Thousands of Short Tons)

	1954	Est. 1955	Est. 1960	Est. 1975
World industrial use	3,683	3,700	3,750	5,000
Production:				
Mine	3,099	3,326	3,450	3,580
Secondary	575	610	700	1,000
Total production	3,674	3,936	4,150	4,580
Balance of production over industrial needs		236	400	420 (deficit)

Table X. Indicated Over-All Costs for Some Producers[5]

	Gross Receipts Per Pound (1)	Over-all Costs (2) Before Taxes	After Taxes
U. S.			
Kennecott (U.S. production-est.) (3)	33.69c	18.69c2	5.62c
Phelps Dodge (3) Own mines (excluding custom copper)	30.78	17.51	23.13
Mexico			
Greene Cananea (Anaconda)	30.87		27.07
Chile			
Chile Copper Co. (Anaconda)	24.60 (4)		21.77
Andes Copper Co. (Anaconda)	24.60 (4)		24.08
Rhodesia			
Mulfulira(Year ended June 30, 1954)	28.47	16.48	21.53

(1) Including incidental recovery of gold, silver, etc.

(2) All costs before net income.

(3) Excluding proportions of gross income, net income and taxes applicable to fabricating divisions.

(4) Chilean Government purchased copper production at 24.50c per pound.

(5) Based on available annual reports up to May, 1955.

and the Index of Wholesale Prices (Bureau of Labor). Both are taken at 1926 equal to 100. They are combined in order to obtain an index of the dollar value of commodities flowing into industrial use. To this combined Index there is compared the annual volume of copper flowing into industrial use within the U. S. multiplied by the annual average price of copper. The two lines show a high degree of correlation.

It is apparent that the volume-price of copper was out of line with the volume-price of other commodities during World War I and again during the 1923-1929 period. In each case the resulting correction of the volume-price of copper was thorough. During the 1932-1936 period the volume-price of copper was too low. Since 1937 the two lines have been reasonable close in their fluctuations.

The trend of the two lines has been sharply upward since the beginning of World War II, a period of only 15 years on which it would be hazardous to base a long-term projection into the future. However, in the face of continuing inflation, attainment of a level of about 600 for the Industrial Production-Commodity Price Index by 1975 would seem to be a reasonably conservative assumption. At this level, the annual copper cost for U. S. industry would be about $1,200,000,000. Industrial use of copper in the U. S. (Chart I) is expected to be about 2-million tons a year.

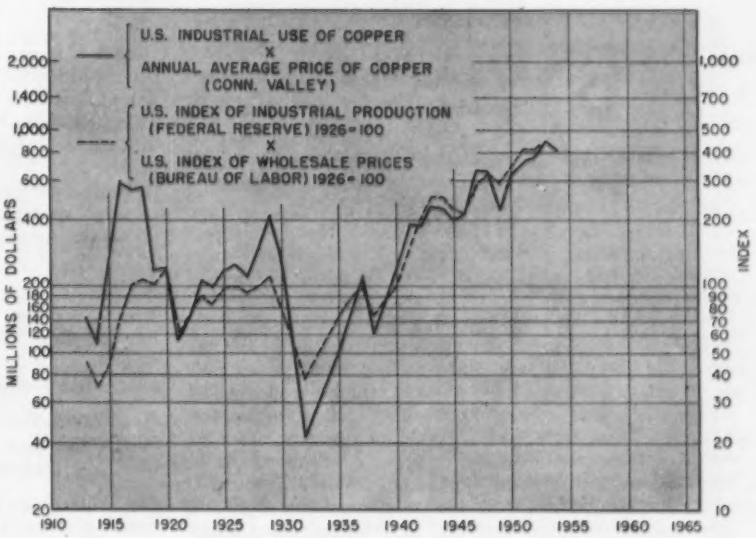


CHART III. Index of industrial production and index of wholesale prices.

If we assume that the volume-price of copper will continue its present correlation with the Industrial Production-Wholesale Price Index, and the long term trend of industrial use of copper in evidence since 1900 will continue; then the expectable price of copper in U. S. in 1975 would be 30.00c a pound.

For 1955, U. S. industrial use of copper is estimated at 1,500,000 tons. At a price of 36.00c a pound the volume-price of copper is about $1,080,000,000, corresponding to 540 on the Index scale. The Industrial Production-Wholesale Price Index for 1955 will probably be nearer 450. This gap of about 20% is likely to be closed by a further rise in the Index above the anticipated 450 level or by a fall in the price of copper from the 36-cent level, or by a combination of the two.

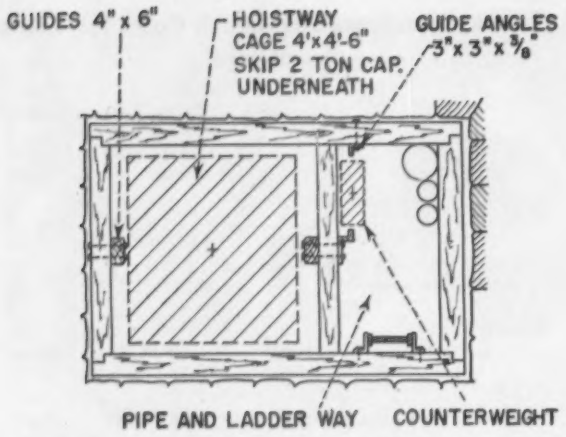


FIG. 1. In simplest arrangement for Koepe hoisting 6x9-ft shaft has counterweight in one compartment.

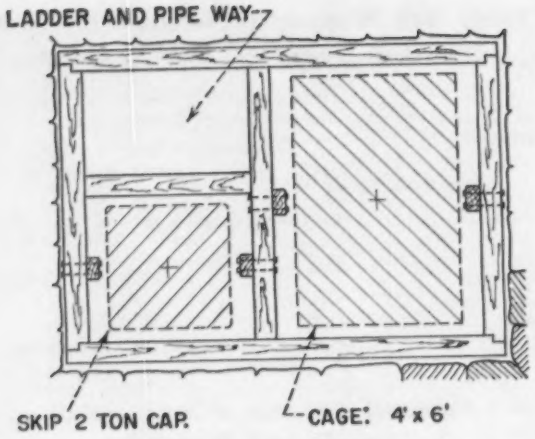


FIG. 2. In 9x12-ft shaft skip goes in one compartment, cage in other. Cage must be heavier here.

Koepe Hoisting System Offers Lower Initial Costs for Small Mines

ROBERT S. MAYO
Mayo Tunnel & Mine Equipment
Lancaster, Pa.

WITH RECENT INSTALLATIONS of the Koepe hoisting system at Falconbridge Nickel Mines of Canada and at Cleveland-Cliffs Iron Co. in upper Michigan, the spotlight has been on friction-drive hoists. But the accent both in the recent North American installations and in the longer and more extensive European experience has been on big mines. Actually, studies indicate that economies offered by friction drive hoists are proportionately greater for small mines.

The small mine has problems entirely different from the big mine. First of all, the amount of ore to be raised each day is small. Secondly, most of these mines are opening up a prospect and in spite of core-drilling and geological surveys, the actual reserves are open to question. Thirdly, many of these mines are being opened by individuals or corporations with limited capital and therefore low first cost is more important than day-to-day economy. Both low first cost and daily economy may be obtained with a modified Koepe system, using a standard friction-drive elevator hoist and eliminating the tail-rope which is not important in shallow mines.

Simplest type of shaft arrangement for friction drive hoisting for a small mine is shown in Fig. 1. The man-cage and the self-dumping skip are both located in one compartment. The counterweight is located in one corner of the compartment which has the ladder and the utilities. This is a compact arrangement and gives overall dimensions of 6 ft x 9 ft which is about as small a shaft as can be efficiently sunk.

Arrangement at stations is shown in Fig. 3. The operator rides in the man-cage mounted right above the skip. He is in a position to watch the loading of the skip and also observe dumping. This arrangement eliminates the need for signal men and the only signal system required is some simple type of call bell. In Fig. 3 cars are shown being dumped directly into the skip, but speed and efficiency would be greatly improved if there was a measuring pocket at each station. It would be very simple to rig up controls at each level so that the hoist operator could load his own skip.

Table I shows preliminary calculations based on a shaft of approximately 300-ft depth, and a hoisting speed of 250-ft per minute.

First Cost

First cost on the equipment for the Koepe system of hoisting should be much less than for conventional methods. The various items that make up this cost will be analyzed for comparison:

Headframe: The cost of the headframe should be approximately the same. While the headframe must support the hoist, the back-leg and the headsheaves are eliminated.

Cage and Skip: The price of these should be exactly the same for either system.

Counterweight: A counterweight is required in the Koepe system but this is of cast iron and is relatively inexpensive.

Hoist: The biggest savings will be found in the hoist. First of all, hoist foundations and hoist-house are eliminated. The hoist used in this system will be of the standard elevator type, small and compact. All controls will be of the conventional elevator type, remote controlled pushbuttons.

Another method of hoisting by the Koepe system is shown in Fig. 2. In this case, the cage is in one compartment and the skip in another compartment operating in balance. It will probably be necessary to increase the weight of the cage to reduce the unbalanced pull on the hoist, therefore the cage itself may cost a little more. A preliminary analysis of these figures is given in Table II.

Thus the unbalanced load, hoisting and lowering would

Table I. Preliminary Calculations for a 300-ft Depth at 250 fpm.

Hoisting	
Man-cage, 4-ft x 4-ft 6-in.	4,000 lb
Skip, 2-ton capacity	3,000 lb
Ore, 2-ton	4,000 lb
Cables, unbalanced	500 lb
Total	11,500 lb
Less counterweight	9,000 lb
Line pull, hoisting	2,500 lb
Lowering	
Counterweight	9,000 lb
Cable, unbalanced	500 lb
Total	9,500 lb
Less cage & skip	7,000 lb
Line pull, lowering	2,500 lb

Horsepower

$$\frac{2{,}500 \text{ lb} \times 250 \text{-ft}}{33{,}000} \times \frac{1}{.85} = 22.3 \text{ hp}$$

Cycle	
Hoisting	1½ minutes
Dumping	¼ minutes
Lowering	1½ minutes
Loading	¾ minutes
Cycle	4 minutes

A 4-minute hoisting cycle would mean 15 trips per hour or 30 ton per hour.

Table II. Preliminary Calculations for Skip and Cage in Counterbalance.

Hoisting	
Skip	3,000 lb
Ore	4,000 lb
Unbalanced cable	500 lb
Total	7,500 lb
Less extra heavy cage (4-ft x 6-ft)	5,000 lb
Line pull, hoisting	2,500 lb
Lowering	
Cage	5,000 lb
Unbalanced cable	500 lb
Total	5,500 lb
Less empty skip	3,000 lb
Line pull, lowering	2,500 lb

be the same as in Fig. 1. However, the total load to be accelerated and decelerated would be much less so that the operating cycle would be speeded up.

The hoist is of the conventional elevator type, with friction-drive on multiple wire ropes attached to skip and counterweight and mounted directly over the shaft. These are standard and many thousands of them are working in all cities under the strictest of safety regulations. The motor may be ac or dc. Direct current motors have many advantages as far as acceleration, variable speed and capacity for overload, but unless direct current is available these advantages will hardly overcome the cost of a motor-generator set to convert ac to dc. Many small mines, in

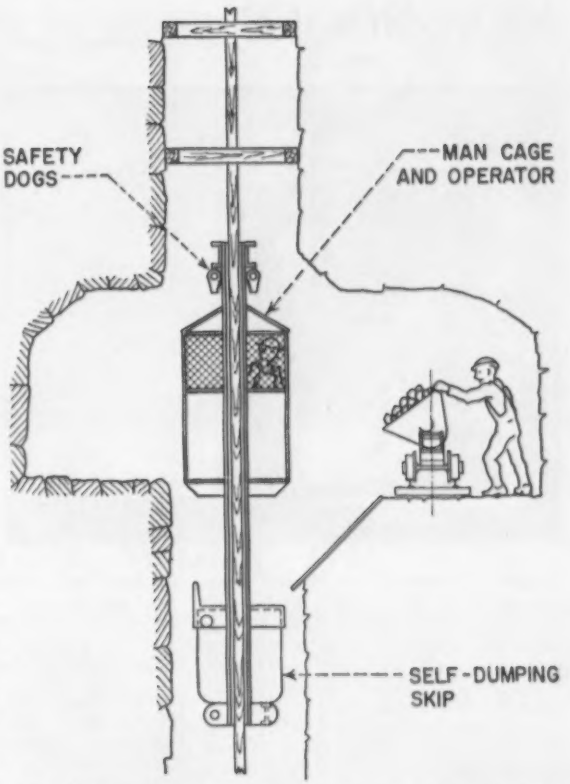


FIG. 3. Arrangement at stations puts man in cage in position to see loading as well as dumping operations.

remote areas, generate their own current. In this case, it is just as easy to purchase a dc generator as an ac, and this dc may be used for lighting in the mine, charging battery locomotives, and operating shop equipment.

Most elevator type hoists are powered by ac motors. These are two-speed motors, the lower speed being used for acceleration and deceleration. Standard elevator practice is to set up "zones" and when the cage enters the selected zone it will automatically shift from high to low speed so that stopping at the desired level is smooth and gentle.

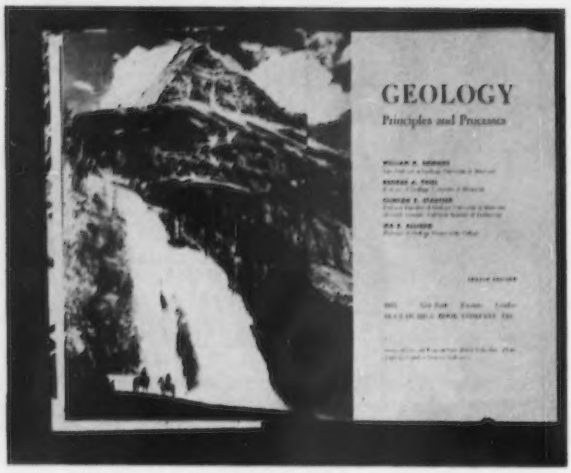
Based on preliminary analysis, we believe that many operators of small mines should more carefully consider the advantages in low first cost, safety and operating efficiency inherent with the Koepe system of raising ore in mines.

Editor's Note: Literature on Koepe or friction hoisting thus far has dealt chiefly with large installations. Hence this contribution by Robert S. Mayo is published to explore the feasibility of friction hoisting in small mine operations.

Worldwide interest in friction hoisting was summarized in "The Impact of Friction-Drive Hoisting," in the 1955 Mid-March Guidebook issue of *E&MJ* which listed important recent literature on the subject.

The Guidebook article "Electric Aspects of Friction vs Drum Hoists," by A. Huelsman and R. B. Moore of General Electric Co., has aroused further discussion on this timely subject, not only on first costs but on power and operating costs as well.

NEW BOOKS



Geology Principles and Processes, by William H. Emmons, G. A. Thiel, Clinton R. Stauffer and Ira S. Allison. 4th edition with vastly improved format; some excellent photography. The writing is simple, the sequence logical. Mathematical and all chemical details as well as unnecessary technical terms are avoided. Many new drawings, photographs and charts illustrate the expository sections. Chapters are followed by references to source material and supplementary reading.

Topics of previous edition are reorganized, revised and augmented by new information based upon recent research. Material includes: a more complete section on chemical weathering, a chapter on work of the wind, an expansion of erosional processes in the desert and classification of soils.

Also included: the work of ice, snow and permafrost in the artic, expanded section on shore-line erosion and deposition by the waves, new concept of mobility of rocks in relation to mountain building and additional data on the origin and geological setting of nonmetallic minerals.

Scope of the book is comprehensive enough to acquaint the student with the basic framework of the science with a minimum of detail. Published by McGraw-Hill Book Company, 330 West 42nd St., New York 36, N. Y. 519 figs. 623 pp. Price $6.50.

Recent Developments in Mineral Dressing, prepared and published by Institute of Mining and Metallurgy, London, England. A symposium arranged by the institute in 1953 at Imperial College of Science and Technology. Covers theory, research, plant practice and new concepts in equipment with recorded comments by critics at the end of each paper. 753 pp. Price unknown.

Petrographic Mineralogy, by Ernest E. Wahlstrom. Review of the technique of petrographic identification which provides all the data necessary for the correct identification and classification of rocks and minerals using the polarizing microscope. Published by John Wiley and Sons, Inc., 440 Fourth Ave., New York 16, N. Y. 391 pp. Price $7.75.

Applied Thermodynamics, formerly entitled Heat Power, by Earle B. Norris, Eric Therkelsen and Clarence E. Trent. 3rd edition. Text is divided into three parts: internal combustion engine, steam generation and compressors. Published by McGraw-Hill Book Company, 330 West 42nd St., New York 36, N. Y. 478 pp. Price $7.50.

South Africa. Volume II, Human Geography, by John H. Wellington. Follow-up of *Volume I, Physical Geography of South Africa.* For an insight into the biggest single unsolved social problem in South Africa look over the section on people. Volume II will stun you with the weight of the problems hanging over the heads of the Europeans in awakening South Africa. Published by Cambridge University Press, 32 E. 57th St., New York 22, N. Y. Population maps, photos and 270 pp. Price $6.50.

Highways to the North, by Frank Illingworth. Travelogue of the Alaskan Highway from Mile Post Zero to Fairbanks, 1,500 miles away. An outsider's look-in on the insiders in modern Alaska. Reminiscences of the Klondike and the Dawson of old as told to the author by the people who climbed the ice over Chilkoot Pass in 1898. A mixture of the new and old with a little grizzly bear hunting thrown in. Philosophical Library Inc., 15 E. 40th St., New York 16, N. Y. Photographs and 290 pp. Price $7.50.

Mining Year Book 1955, by Walter E. Skinner. 69th edition of this handbook which lists 968 mining companies, exploration work, production and financial activities in many parts of the world. Contains a who's who, voting rights and market quotations. Published by Walter E. Skinner, 20 Copthall Avenue, London, E. C. 2, England. Price 30/. US $7, post free.

Nachschlagewerk für die Montan-Union. The reference book for the Montan-Union published by C. L. Krueger, Dortmund, Germany. Available in the U. S. from Business Publications, P. O. Box 154, Mamaroneck, N. Y. In French and German with index of firms also in English. Montan-Union is the industrial giant of Europe. An organization of the pooled resources of the mining, steel and heavy industry of Germany, France, Netherlands, Belgium, Luxemburg and Italy. 9x12 in. 1,000 pp. Price $15.

Reports and Bulletins

Uranium Deposits in South Australia. Bulletin No. 30, by Geological Survey of South Australia. Photographs, figures and color map. 151 pp.

Report of Legislative Commission on Taxation to the Minnesota Legislature of 1955. Covers past Minnesota iron ore tax history, mining history in the state, ore dessing technique, state laws in existence that cover iron ore, taxes imposed elsewhere in the U. S., Canada and several South American countries, iron ore reserves of most of the world, competition of Minnesota ore with rest of the world and recommendations of the commission. Commission recommended no further tax increase unless necessary. 224 pp.

Regional Tectonics of the Colorado Plateau and Relationship to the Origin and Distribution of Uranium, by Vincent C. Kelly for the University of New Mexico Publications in Geology with the cooperation of the AEC, 1955. 8 pages of photographs, 17 drawings in 120 pp. An excellent map of the Plateau showing limbs, folds, faults, veins, plugs, dikes and all the known uranium deposits in the area. Map covers Utah, Colorado, Arizona and New Mexico area of the Plateau. Issued by University of New Mexico, Albuquerque, New Mexico. Price $2. Map only, $1.

The following U. S. Geological Survey reports may be obtained from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Bulletin 1009-E. Stratigraphy of the Morrison and Related Formations, Colorado Plateau Region. A Preliminary Report, by Lawrence C. Craig, Clifford N. Holmes, Robert A. Cadigan, Val L. Freeman, Thomas E. Mullens and Gordon W. Weir. 41 pp. Price 20c.

Bulletin 1015-H. Preliminary Geophysical Studies of the Capital Reef Area, Wayne County, Utah, by Lyman C. Huff. 9 pp. Price 15c.

Circular 7707. Black Hills Mineral Atlas, South Dakota. Part II of two, by Region V staff. Tabulates and elaborates on known mineral deposits in this area. Cites claims, both patented and unpatented, owners, assessment and development work to date, production where known and mineral content of each claim. 208 pp.

Circular 359. Uranium Bearing Sandstone in the White River Badlands, Pennington, County, S. D. Written by George W. Moore and Murray Levish for the AEC. 7 pp.

Bulletin 1011, Pegmatites of the Crystal Mountain District, Laramie County, Colorado, by William R. Thurston. 179 pp. with maps.

WHITE PINE COMMUNITY LIBRARY in action, staffed by library board and members of White Pine Women's Club. Library now boasts over 1,500 books and current magazines contributed by many persons from all over the United States.

They're Booked Up at White Pine

Or: Never Underestimate the Power of . . .

IN MICHIGAN'S UPPER PENINSULA, White Pine, a mining community of about 1,000 residents, does not live by copper ore alone. In this town of no movies and dubious radio and television reception—there is a library. It wasn't always so.

Just a year ago, libraryless White Pine was slim pickings for even the lightest reader. After running through their own and the neighbors' meager supply of books and magazines, local residents faced a 40-mile round trip to the nearest library, or the umpteenth re-reading of "Gone With the Wind" and "The Caine Mutiny."

Then suddenly the White Pine Women's Club decided it was time for action. Armed with spirit, determination and a $200 club treasury, they . . .

- Held benefit card parties to raise additional funds to purchase books.
- Spotted a storage room in White Pine's modern school, equipped with enough shelves, tables, chairs and built-in desk space to make an ideal library; then talked school officials into letting them use it.
- Canvassed every home in White Pine for donations of books and magazines.

So overwhelming was response that it won for the White Pine Women's Club the annual award of the Federated Women's Clubs of Michigan for "Outstanding Library Service." The award, an engraved silver plate, appropriately decorates a wall of the library.

Typical of the responses generated by WPWC enthusiasm:

- Several neighbors donated best sellers ordered to exchange among themselves.
- One couple, avid readers, donated several cartons of books. Returned every week to scan the shelves for other new donations.
- Incoming family, hearing of the new library, brought in 300 volumes as a gift, instead of throwing them out before moving.
- Visiting salesmen donated $25.00 for more books.
- Other District Women's Clubs organized a "book shower" for the White Pine Club.
- Several Michigan libraries sent books, and Pastors of the three churches in White Pine gave appropriate volumes.
- At a member's suggestion, notice published in AIME Women's Auxiliary Bulletin prompted a flood of books from all over the country.
- Even the Michigan Historical Commission sent a state history.

WOMEN BEHIND THE LIBRARY (seated) Mrs. Harold Ewoldt, left, and Mrs. Walter Hamilton, holding the award the Women's Club won. Standing from left are Mesdames Fred Dunham, Virgil Lessels, Richard Moe, Raymond Posey and S. H. Cohlmeyer.

Grand total to date: over 1,500 books and stacks of current magazines.

To staff and manage the library efficiently, the Women's Club formed a library board. At organizational meetings, Samuel E. Molod, Michigan State Library Consultant, gave them advice and arranged for loan of several hundred books from the State Library on a six-month basis.

Almost every member of the White Pine club contributes of her time and energy. Schedule of working hours, posted in the library and circulated during club meetings, is cheerfully filled up weeks ahead.

Today, the White Pine Community Library draws about 300 patrons—nearly one-third of the population. Grateful citizens agree that it makes for better living. And full credit goes to the community-conscious White Pine Women's Club with a notable assist by members of the AIME Women's Auxiliary all over the U. S.

House Group to Study Role of Industry Expert in Government

ALLEGATIONS that Howard I. Young, president of American Zinc, Lead & Smelting Co. and president of American Mining Congress, acted under conflicting interests while in Government service—promptly and emphatically denied by Young and Jess Larson, his DMPA superior—generated other activity on Capitol Hill.

- Evidence discussed by the Joint Congressional Committee on Defense, produced by the General Accounting Office, led to scheduling of hearings by Rep. Emanuel Celler's (D-N.Y.) House Judiciary Committee on the general subject of private enterprise executives serving in Washington without Government compensation. One of the questions under discussion was whether the WOC's (With Out Compensation) could legally hold administrative positions, as Mr. Young did when he was director of the Defense Materials Procurement Agency during the Korean conflict; or whether their much-needed services should legally be limited to advisory and consulting positions.
- Passage of the Defense Production Act was tightened along the lines of Government activities handled by private enterprise advisors.

Although no charges against Young were produced in the closed hearings of the Joint Congressional Defense Committee, testimony was turned over to the Justice Department. Chances are it will take no action.

Testimony before the joint committee produced no evidence of criminal activities against Mr. Young. In fact, the highly controversial testimony boiled down to a series of complex and opinionated discussions of the Government's zinc-buying program during the Korean War, as administered by Young's agency, DMPA, which was directly under the administration of Jess Larson, then director of General Services Administration. Young joined DMPA on Sept. 13, 1951.

William L. Ellis, Chief of investigations for the General Accounting Office, produced three principal charges against young: 1) That while Young was Administrator of DMPA, his company, American Zinc, Lead & Smelting Co., made direct financial gains from his decisions; 2) That Young's recommendations pushed the country into an expensive zinc-buying program at a time when there was no apparent emergency in zinc supplies; and 3) Regardless of the outcome of the previous charges, the deals ar- of previous charges, deals arranged for the Government by Young's office to buy zinc were unsound business-wise.

GAO pointed out that, although no direct contracts were signed by DMPA with American Zinc, Lead & Smelting Co., contracts were signed with three small zinc mining companies, which in turn could use the money to either repay AZL&SC for past advances, or contract for additional business with American Zinc to process ore for the Government.

At the time the contracts were signed, the three companies were under question from other Government sources as being marginal producers, and therefore poor risks for Government loan guarantees or advances. These three companies were the Mid-Continent Mining Co., the WM&W Mining Co., and the McArthur Mining Co. WM&W Co. currently owed American Zinc some $30,000 from a previous advance, which it was not then able to pay. Mid-Continent was unable to obtain a guaranteed loan from the RFC at that time, and eventually obtained a $325,000 advance for zinc mining through Mr. Young's recommendation. McArthur eventually received a $45,000 advance. WM&W received a $70,000 advance. After several unfortunate occurrences following receipt of the advances, Mid-Continent was unable to produce any zinc, WM&W produced 700 tons for the Government and McArthur produced 600 tons.

Ellis claimed that American Zinc's total capacity for zinc smelting was about 10% of the nation's capacity, while it received 47% of the DMPA contracts for zinc smelting while Young held his post.

Jess Larson, speaking before the committee, said that Young was directly under his office since the DMPA was partially bound to the GSA and that Larson had requested Young to be his assistant. Larson added that all documents and contracts under discussion were signed by himself as final authority on the matter, and that if there were any irregularities, they were his responsibility, and not Young's. Larson complimented Young as being scrupulously ethical and honest.

Howard Young took the floor to deny there had been "conflicts of interest" in his mind while serving as DMPA director. He claimed he had stayed out of business dealings directly with his company or its subsidiaries. He pointed to a low reserve of zinc in late 1950.

Countering Ellis' charge that there was not a shortage of zinc, Young said it took up to five years to effect a change in the zinc supply, and that in 1954, nearly five years from the time he held his post, zinc reserves were at their lowest point since 1934.

Young summed up his position in six points: 1) He had made full disclosure of his financial income, which was acceptable to the Government; 2) DMPA was fully aware of all dealings with American Zinc during his administration; 3) No financial advantage was given American Zinc during his administration; 4) There was no need for more business to American Zinc since they were already swamped with zinc orders; 5) American Zinc needed no more smelting business, since their smelters were running at full capacity; and 6) Government contracts during this time accounted for from 0.78% to 2.72% of AZL&SC business.

Young said he had made no financial gain from any alleged zinc dealings between his firm, the Government, and any possible middle companies. He also said that he considered the contracts he recommended in 1951 as sound then, and that he would probably still recommend them as sound.

GSA Report Hits DMEA Extension Proposals; Says Ore Could Not Enter Present Stockpile

EXTENSION proposals of the DMEA of 1953 have brought out a violent opposition report from General Services Administration. Although the report was aimed at the Senate bill, S.922 which has been technically killed, the wording appears applicable generally to the House bill, H.R.6373, which has received favorable reports from the Department of Interior, and the Budget Bureau.

Reporting on the proposed increase in purchase of asbestos, beryl, chrome, columbium-tantalum, manganese, mica and tungsten, GSA said that in almost all cases, the ore purchased would be of inferior grade, which could not be admitted into the Government's stockpile program. Because of this low quality, GSA doubted if it could be sold on the domestic market.

Through March 31, 1955, GSA had bought 847 short tons of the P.L. 206 quota of 1,500 short tons; 626 short dry tons of a 1,500-ton beryl quota; 82,402 long dry tons of a 200,000-ton chrome quota; 9,084,159 pounds of a 15-million-lb columbium-tantalum quota; 11,878,-867 long-ton units manganese of a 37-million quota; 5,503 short tons mica out of a 25,000-ton quota; and 1,677,453 short ton units of tungsten from a 3-million short ton unit quota.

As planned by H.R.6373, these quotas would be doubled, except for manganese which would be tripled. An amendment to the act has limited purchases to $150-million, after some estimates placed the cost of the expanded program at a possible $500-million.

GSA said that asbestos and beryl pur-

chased would probably not be of stockpile quality, with little chance of resale to industry. Columbium-tantalum cannot be stockpiled, as that quota is full; and manganese would have to be upgraded from its purchased quality of 20-25% to a stockpile minimum of 40% although no beneficiation contracts have yet been let.

Aluminum Investigators Approve ODM-GSA Action

THE ALUMINUM production-consumption battle has about played out in Washington, with representatives of both House committees investigating the primary production operations saying the situation was being carried on in a respectable manner. Emanuel Celler (D-N.Y.) chairman of the House Judiciary Committee, gave a pat on the back to Kaiser and Reynolds and to the ODM-GSA operations for distributing aluminum to non-integrated fabricators. Representatives Steed (D-Okla.) and Sheehan (R-Ill.) told Sidney Yates (D-Ill.), chairman of the three-man Committee on Minerals and Raw Materials, that they disagreed with his findings, stating they felt the "Big Three" were doing as well as could be expected of them in primary production, and that the Government was doing a fine job in handling stockpile deferrals.

All 400-million tons of aluminum scheduled for the stockpile in the third quarter of 1955 has been released for domestic consumption.

As the aluminum situation maintains its status quo, chances become less certain that ODM will initiate a new round of primary production expansion incentives. Olin-Mathieson, St. Joseph Lead and Harvey are all potential primary producers. Anaconda is scheduled to produce in late summer. Kaiser, Reynolds and Alcoa have all indicated enlarged facilities.

Copper Shortage to Continue

SUPPLIES of copper seem to be headed for extreme scarcity for months to come, with reserves in many fabricating plants down to only a few days' supply. Office of Defense Mobilization has talked of drastic steps to regulate the situation, with emergency civilian priority control a consideration, although this will probably not be carried out. Third quarter diversion of copper stockpile deliveries has already been effected, but domestic strikes have withheld a greater quantity than that diverted from the market. A good probability for increased control will be curtailment or cancellation of copper scrap exports.

Labor This Month

MINE-MILL STRIKE: A two-edged sword: The walkout by the Mine Mill & Smelter Workers Union, on the surface, was successful strategy by the union. Pay increases ranging up to 15c were won; a higher settlement than even its officials anticipated. Their biggest assist was not due to strike tactics; it came from the settlement in the steel industry that set a goal for the mine union to work for.

To Mine-Mill leaders there was another good omen. In the face of recurring reports that the left-wing union was losing ground, its members —for the most part—were staunchly behind the walkout. They succeeded in closing down most of the copper industry. Its effectiveness was evident in industry appeals to the Government to release copper supplies from the Federal stockpile. But there were bad omens too.

BUTTE LOCAL REFUSES TO STRIKE: The decision by local officials in Butte, Mont., not to join the walkout was a blow to Mine-Mill leadership. It's a Mine-Mill stronghold, dealing with the Anaconda Copper Co. But the leadership decided, against the advice of International leaders, not to walk out for a wage increase—and it won anyway with a pay raise ranging from 11½ to 17c an hour. International officers were in on negotiations with Anaconda, but the local did the actual bargaining and can make a claim of rewards without strike action. This puts Mine-Mill in an embarrassing spot, and in a poor position with the rank-and-file membership.

LABOR UNITY IS IN THE BAG: The last remaining obstacle to AFL-CIO merger was ended with the selection of a name. It's to be called the AFL and CIO. Combination of names was the result of both sides refusing to give ground; AFL wanted to keep its title; CIO wanted an entirely new label. Final affiliation will be completed in December.

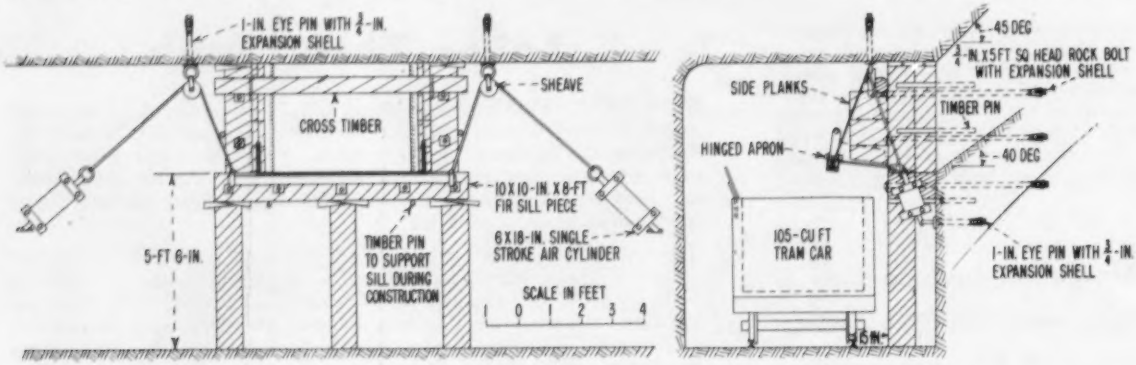
AFL-CIO unification will be made without the independents—such as Mine-Mill, despite the appeals by the mine union to be let in. In the past, MMSW has tried to tie-up with either the AFL or CIO before the merger event. Now the strategy has changed—but still with no results.

MMSW tactics are not directed at the AFL alone, with its publications writing nice words about AFL president George Meany. At the same time, these same papers are denouncing CIO Steelworkers president David McDonald as "King of Scabbery." The reason: The union is up in arms at attempts by the steelworkers to take over bargaining rights at Mine-Mill locations. Though McDonald's group is making little headway, his union is still plugging away. Latest challenge to Mine-Mill by the Steelworkers occurred at American Smelting & Refining Co.'s El Paso, Tex., plant, where the CIO group tried to wrest bargaining rights from the mine union. Final vote in the official NLRB election poll was 441 for Mine-Mill, 256 for the steel union.

But, despite the appeal, to Meany, Mine-Mill isn't winning friends in the AFL. The left-wing label pinned on MMSW for Communist-domination still stands and Meany won't deal with the leadership. In addition, the attack on McDonald will make him fight harder to keep the union out of the merged organization when it combines in December.

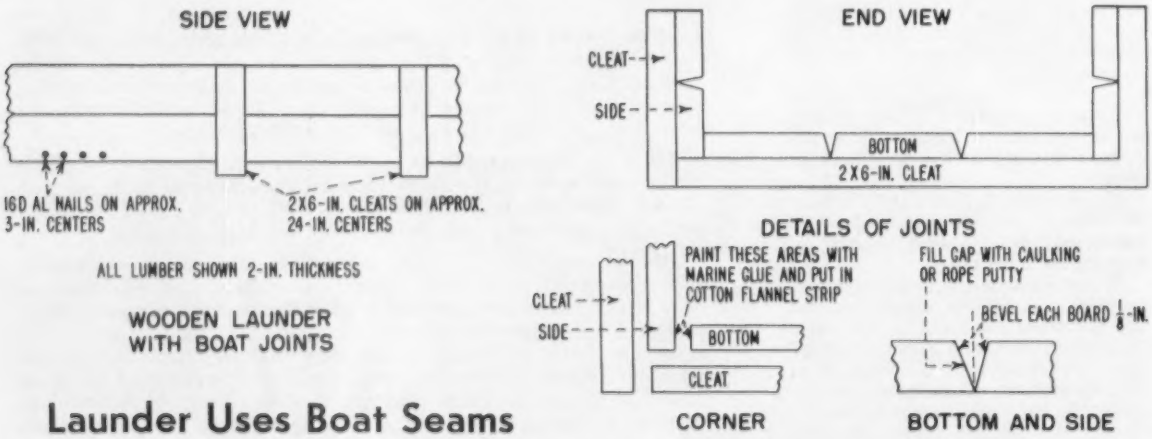
FEDERAL ATTACK ON LEFT-WING UNIONS IMMINENT: Justice Department is ready to wield the axe against CIO-expelled unions but which unions will be the first to be hit is being kept secret. It could be Mine-Mill. In relaying the coming action, a Justice Department official declined to pin-point the union but significantly mentioned the two Mine-Mill leaders who have been in court on charges of filing false Taft-Hartley non-Communist oaths—Clinton Jencks and Maurice Travis.

The Government's first step will be to take evidence to the Subversive Activities Control Board that a union is Communist-dominated. If the board agrees, the Government will bar that union from bargaining with employers.


1-IN. EYE PIN WITH ¾-IN. EXPANSION SHELL
SHEAVE
CROSS TIMBER
10 X 10-IN. X 8-FT FIR SILL PIECE
6 X 18-IN. SINGLE-STROKE AIR CYLINDER
5-FT 6-IN.
TIMBER PIN TO SUPPORT SILL DURING CONSTRUCTION
SCALE IN FEET
0 1 2 3 4
45 DEG
¾-IN. X 5-FT SQ HEAD ROCK BOLT WITH EXPANSION SHELL
SIDE PLANKS
TIMBER PIN
HINGED APRON
40 DEG
105-CU FT TRAM CAR
1-IN. EYE PIN WITH ¾-IN. EXPANSION SHELL

Chute Saves Labor, Material and Repairs By Using Rock

COUNTRY ROCK is used as much as possible in making this rock-bolted apron chute. Mine superintendent V. J. Capobianco, the chute designer, reports Copper Range Co. found that it gave considerable saving in manpower, materials and maintenance. At one shrinkage stope over 15,000 tons were trammed from one chute with but minor maintenance. Then when stope was emptied all major items were used again to build another similar chute. In drawing above details of construction are given. Note small space required and abundant use of rock bolts which minimizes blocking and bracing and still strengthens for low maintenance. Simple pins are used to support timbers during erection until rock bolts are placed.



Launder Uses Boat Seams

BY TAKING A TIP FROM BOATBUILDERS, better and cheaper launder joints are now used at St. Joseph Lead Co.'s Desloge Unit. According to M. N. Dunlap, mill superintendent, it was an ex-sailor who convinced the rest of the mill carpenter crew that "man's oldest effort to control water with wood—boat seams—" was worth substituting for the old rabet-and-moving-tongue connection. Not only simpler and hence easier and cheaper to make, they are also more flexible and thus cut down leakage.

The "how" is shown on the accompanying sketch, but here are a few "whys":

All material must be primed with a good grade of paint or varnish and allowed to dry thoroughly before it is assembled. If this is not done, the dry wood will pull the softening agents out of the glue and the caulking material. These materials will then harden, shrink, and leaks will develop.

It will be noted that the butt joints (where bottom meets sides) are made by first coating both surfaces with liquid marine glue, applying a strip of cotton flannel to one glued surface, and then painting the dry flannel surface with liquid marine glue before bringing the joint into contact. The portions of the joint that are not exposed to the oxidizing effects of the air will never dry. For that same reason, they will remain elastic and resist leakage.

The nails used are 16d aluminum—aluminum because the swelling of a rusted iron nail can split the edge portions of the bottom boards.

It will be noted that the two-in. members which meet edge to edge (bottom boards, for example) are each beveled one-eighth inch. This is done so that if priming fails to keep moisture out of the wood, the crushing caused by swelling will be restricted to a small zone. Moreover, the "V" provides a definite opening that can be packed with a flexible material.

The marine caulking or "rope" putty (such as is used for glazing greenhouses) for filling the above one-quarter inch gap, produced by the beveling, remains plastic for long periods of time on primed surfaces and therefore takes care of any movement of the wood.

If no marine supply houses are at hand (many sporting goods stores carry the materials), liquid marine glue and marine paints, varnishes and paints can be secured from L. W. Ferdinand Co., Newton Lower Falls, Mass. or H. B. Fred Kuhl, Brooklyn, N. Y. Both firms will supply catalogues.

The cotton flannel or flannelette can be bought at most dry goods stores and ripped to the desired width.

Recently, with the apparent success, the "rope" putty mentioned was substituted for caulking compound. It is easier to handle and goes into place faster.

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* tough, brown natural rubber cover gives excellent cut and abrasion resistance—protects unique construction under extreme service conditions.

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PERSONALS

Phillip J. Shenon (left) and **Roy P. Full** (center), mining geologists of Salt Lake City, have established a branch office of their firm in Grand Junction, Colo. **A. L. Payne** (right), associated with the firm for the past two years in Cuba, will be in charge of the new office. He previously was associated with American Smelting and Refining Co. in South America.

Thomas J. Hubbard, maintenance and construction engineer, Chino Mines Division, Kennecott Copper Corp., has been named general master mechanic, Magna Mill, Utah Copper Division of the company.

Richard W. Lottridge, assistant to the vice president, Combined Metals Reduction Co., has been named assistant to the president, Federal Uranium Corp.

George A. Soutter, retired comptroller, Utah Copper Division, Kennecott Copper Corp., has been named secretary-treasurer and business manager of Star Dust Mines Co.

Warren Ove, formerly with the Idaho Bureau of Mines and mining division of Grand Junction Operations Office, AEC, has been named geologist for Jackpot Oil Co., Denver, Colo.

Three new directors have been added to the board of Uranium Corporation of America: **Louis Buchman,** retired vice president and general manager, western mining divisions, Kennecott Copper Corp.; **V. S. Vickers,** Salt Lake City certified public accountant; and **D. A. Liddell,** New York metallurgist.

J. E. Berg, general manager of American Smelting & Refining Co.'s northwest mining company, has retired after 32 years with the company and its subsidiary Federal Mining & Smelting Co., merged with the parent firm in 1953. **J. C. Kieffer,** assistant general manager, succeeds Mr. Berg, who will continue in a consulting capacity. **Sergei C. Zelenkov,** manager of Asarco's Northern Peru Mining and Smelting Co., succeeds Mr. Kieffer.

Gailen T. Vandel, La Oroya, Peru, general superintendent of concentration, Cerro de Pasco Copper Corp., was awarded the professional degree of mineral dressing engineer at the commencement of Montana School of Mines.

Thomas D. Henderson, mill superintendent, Copper Cities Mining Co., Miami, Ariz., was recently honored at the commencement exercises of University of Arizona, receiving the professional degree of metallurgical engineer.

John G. Barry, former chief mining geologist, American Smelting and Refining Co., has been named staff engineer, Exploration Division, Atomic Energy Commission, succeeding **David D. Baker,** now deputy director of the Mining Division. **Arthur E. Granger,** with AEC since 1954, has been named chief of the Geologic Branch, succeeding **Robert J. Wright,** who resigned to enter private business.

Murrin Held, formerly in charge of the news bureau of Aluminum Co. of America, has been appointed to the public relations department of Allegheny Ludlum Steel Corp. **Robert H. Kaltenhauser, John E. Mosser Jr.** and **David L. Raymer,** have been appointed research metallurgists at Allegheny Ludlum's research laboratory in Brackenridge, Pa.

John S. D. Tory has been named chairman of the board, McIntyre Porcupine Mines, Ltd. He was recently appointed a director to fill the vacancy due to the resignation of **Edgar D. Fox.**

Edwin H. Crabtree, Jr., deputy manager of the Grand Junction Operations Office of the Atomic Energy Commission has been named director of the Colorado School of Mines Research Foundation, Inc., by president John Vanderwilt.

Everett L. Joppa, manager of mines since 1953, has been appointed general manager of mines, Pickands Mather & Co. Mr. Joppa has been with the company since 1928.

Harold L. Price has been named director of the newly established Division of Civilian Application, U. S. Atomic Energy Commission. The new division takes the place and assumes the responsibilities of the Division of Licensing. **Dr. Frank K. Pittman,** deputy director of Division of Licensing, has been named deputy director of the new division.

Frank E. McGinley has recently been transferred by the Division of Raw Materials, AEC, from Plant City, Fla. to the Grand Junction Operations Office, Grand Junction, Colo.

William L. Kleitz, president and director, Guaranty Trust Co. of New York, has been elected a director of American Smelting & Refining Co.

Gilbert W. Humphrey, vice president, M. A. Hanna Co., has been elected to the board of directors of General Electric Co.

Walter K. Scheibe is now assistant manager, Liberia Mining Co., Ltd., in Monrovia, Liberia, West Africa.

Harold J. Egan, director of Can-Amera Oil Sands Development, Ltd., Calgary, Canada, has been named president, succeeding **Stanley M. Paulson,** who will remain a director.

Robert D. Hill, former executive vice president, Taylor Wharton Steel Co., has been elected vice president and controller, Freeport Sulphur Co., succeeding **Richard C. Wells,** who resigned as controller to become president of National Potash Company, a newly formed company jointly owned by Freeport and Pittsburgh Consolidation Coal Co.

Walter B. Carlson, formerly on the staff of the AEC Controller in Washington, D. C., has been named director, Finance Division of the Grand Junction

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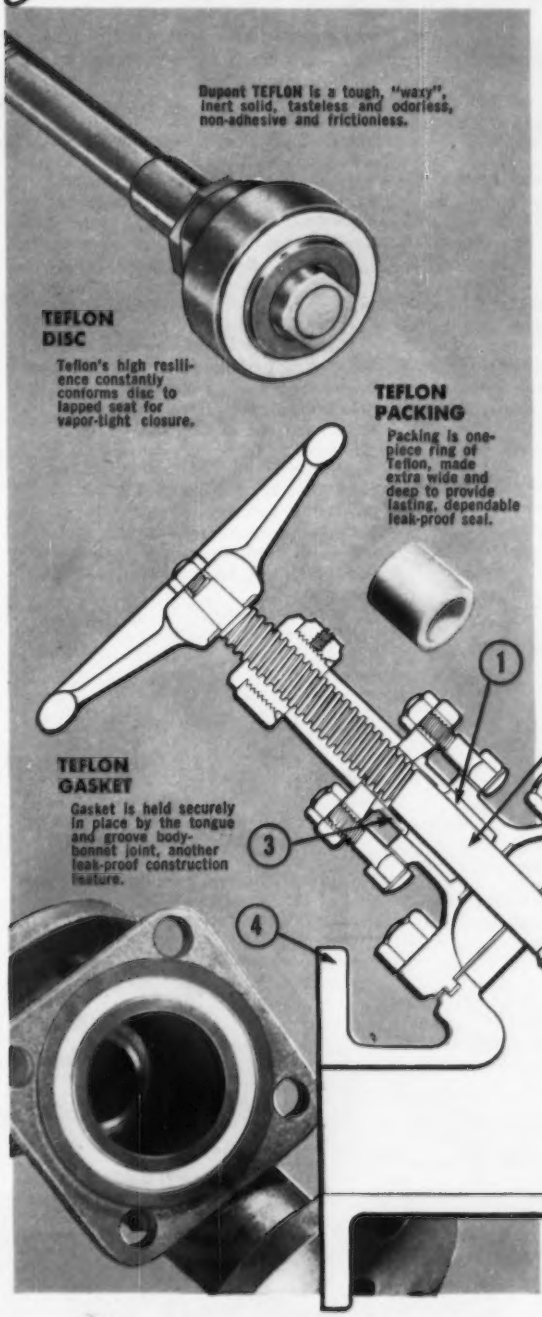
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Packing is one-piece ring of Teflon, made extra wide and deep to provide lasting, dependable leak-proof seal.
TEFLON GASKET
Gasket is held securely in place by the tongue and groove body-bonnet joint, another leak-proof construction feature.
1
2
3
4

FULL, FREE FLOW
through Fig. 1335 is nearly equal to flow through a gate valve.

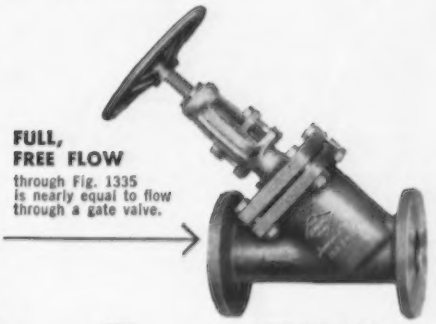


Fig. 1335 "Y" GLOBE
150 lbs. O.W.G. at 500°F
230 lbs. O.W.G. at 100°F
Sizes 1" to 4"

(1) **Packing Box**—Exceptionally deep and wide to hold optimum size packing.

(2) **Spindle**—Polished shank, long-operating threads, bevel shoulder for backseating.

(3) **Gland**—Two-piece for equalized pressure, tight seal.

(4) **Flanges**—Conform to M.S.S. Standard Practice S.P.42 Specifications.

JENKINS STAINLESS STEEL VALVE BOOKLET illustrates and describes wide range of Jenkins Globe, Gate, Check, and Y Valves, includes selection data, survey forms. Ask for Form 200-A.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES

PERSONALS *(Continued)*

William L. Walsh, former assistant to the president of Kennecott Copper Corp., has been named president of Quebec Iron and Titanium Corp., two-thirds owned by Kennecott.

Operations Office, AEC, succeeding **D. F. Pelan** who resigned to enter private business.

Consolidated Mining and Smelting Co. of Canada, Ltd., has announced the following appointments upon the retirement of **H. C. Giegerich,** Aug. 1: **P. T. Bloomer,** operating superintendent, Sullivan mine, to general superintendent, Outside mines; **R. M. Porter,** acting property superintendent, Tulsequah Mines Ltd., to operating superintendent, Sullivan mine; and **J. J. McKay,** property superintendent, Nong Bhai mine, Thailand, to property superintendent, Tulsequah Mines Ltd. **J. C. MacLean** has been appointed property superintendent of H. B. Mine.

Lee Heidenreich, formerly of Pioche, is now general superintendent, Linka Tungsten mine of Consolidated Uranium Mine, Inc. in Nevada.

Nevada Mines Division of Kennecott Copper Corp. has made the following personnel changes: **Frank Quilici,** formerly in charge of operations, Isbell Construction Co., is now superintendent at Liberty and Veteran Pits; **Frank G. Woodruff,** safety director, has been named general superintendent of the mill and smelter at McGill; and **Rush Muse,** former mine industrial engineer at Ruth, is now pit general foreman.

Moab Mines, Inc. has announced the appointments of **William R. Ellis** and **Ronald F. Seibel** to the company's field operations staff.

A. J. Carrado, engineering administrative assistant at American Potash & Chemical Corp.'s main plant at Trona, Calif., has been named personnel and office manager, American Lithium Chemicals, Inc., San Antonio, Texas. He joined American Potash in 1942.

Col. T. R. Gillenwaters, former industrial counsel of Uranium Engineering Co. of Grand Junction, Colo., has been named president and chairman.

John Croston, mining engineer for the General Services Administration, has returned to Washington from a visit to the Nicaro nickel plant in Cuba, and bauxite mining operations in Jamaica, Haiti and the Dominican Republic.

Samuel H. Marshall and **Robert M. Turpin** were elected directors of U. S. Smelting Refining and Mining Co. to fill vacancies resulting from the recent death of **John R. Macomber** and the resignation of **Bradley Dewey. C. G. Rice,** vice president and general manager, oil operations, was named executive vice president; **J. V. Neuman Jr.,** manager, Southern Division, was elected vice president and **H. C. Peacock,** former assistant to the president, was named assistant to the executive vice president.

Zodomock Mines, Inc. has elected **Donald DeLuche,** supervisor, president. **Albert Zufall,** retiring president, succeeds DeLuche as secretary-treasurer. **Karle Goff,** mill supervisor, remains vice president.

E. C. Peterson, assistant engineer, Mahoning iron mine, Pickands Mather & Co., has been transferred to the Carmi iron mine as assistant engineer.

Emmitt Coughlin, superintendent, Corsica iron mine, and **George W. Chamberlin,** district engineer, Cuyuna iron range, Pickands Mather & Co., retired April 30.

William D. Trevenna has been named Montana state metal mine inspector succeeding the late **Richard Mecredy.**

Nelson J. Darling Jr., Walter Hochschild and **Harold B. Ewoldt,** have been elected to the board of directors, Copper Range Co.

Alexander Brown, chairman of the board, Cleveland-Cliffs Iron Co., has been elected a director and chairman of the committee on iron ore of the American Iron and Steel Institute.

George Fansett, mining engineer with the Arizona Bureau of Mines, University of Arizona, retired July 1 after 39 years of service.

L. E. Davis is now mill superintendent, Tempiute Mill, Wah Chang Mining Corp., Tempiute, Nevada. **Fred Yarcho,** former mill superintendent, is now research metallurgist.

Sullivan Mine team of Consolidated Mining and Smelting Co., Kimberley, B. C., won the senior men's first aid championship of Canada. Team men are **J. H. Davis,** captain; **J. E. Jacobson; W. D. McArthur; C. J. Leonhardt** and **A. Caldwell. J. H. Shaw** is coach.

David F. Shaw, manager, Hanford Operations office, AEC, Richland, Wash., since 1950, has been named assistant general manager for manufacturing. **James E. Travis,** assistant manager at Hanford since 1950, succeeds Mr. Shaw.

Hans J. Bosshardt is now foreman in the Paragsha Concentrator, Cerro de Pasco Corp., Cerro de Pasco, Peru.

Paul W. Allen, plant manager, National Lead Co.'s Ilmenite Mines at Tahawus, N. Y., has resigned to accept a position with Cyprus Mining Co., in Los Angeles, Calif. He is succeeded by **John Hall,** former assistant plant manager. **Archie McDonell,** chief engineer, and **Charles Begor Jr.,** general superintendent, have been named assistant plant managers.

Richard J. Greene, metallurgist, has been named head of the new Southeast States Technical Field Section of the development and research division, International Nickel Co., Inc.

Andrew Fletcher, president, St. Joseph Lead Co., has been elected president of the Lead Industries Association at its 27th annual meeting in Chicago, succeeding **J. B. Haffner,** former president of Bunker Hill & Sullivan Mining & Concentrating Co.

Robert F. Brown, former mill superintendent, Batong Buray Gold Mines, Luzon, P. I., has joined the staff of Atlas Consolidated Mining & Development Corp., Toledo mine on Cebu Island, Philippines.

William F. Jamieson, formerly associated with U. S. Vanadium and Consolidated Copper, has become chief mining engineer, Moab Mines, Inc., Moab, Utah.

Robert H. Bassett, consulting chief engineer, M. A. Hanna Co., has retired after 38 years of service.

John A. Nicolson, North Range Mining Co., Negaunee, Mich., has been trans-

J. E. Lange (above) has been named Cleveland district sales manager for *Engineering & Mining Journal* and *Coal Age,* succeeding **W. M. Spears** who is retiring September 1. Mr. Lange for the past two years has been Western district direct mail representative for McGraw-Hill in Chicago. Prior to joining McGraw-Hill, he was associated with Pickands Mather & Co., in Cleveland.

KENNEDY UNI-FORM CARRIER ROLLS CUT OPERATING AND MAINTENANCE COSTS

and they improve operation too!

NEW, ONE PIECE, STEEL CARRIER ROLLS ADD 50% GREATER STRENGTH TO TROUGHING AND RETURN CONVEYOR BELTS

Deep drawn steel tubular rollers of 5" and 6" diameter, uniform in weight, thickness and balance, pressed from hot rolled plate to form a smooth, carrying surface. Roll ends contoured to eliminate belt pinching and provide longer belt life.

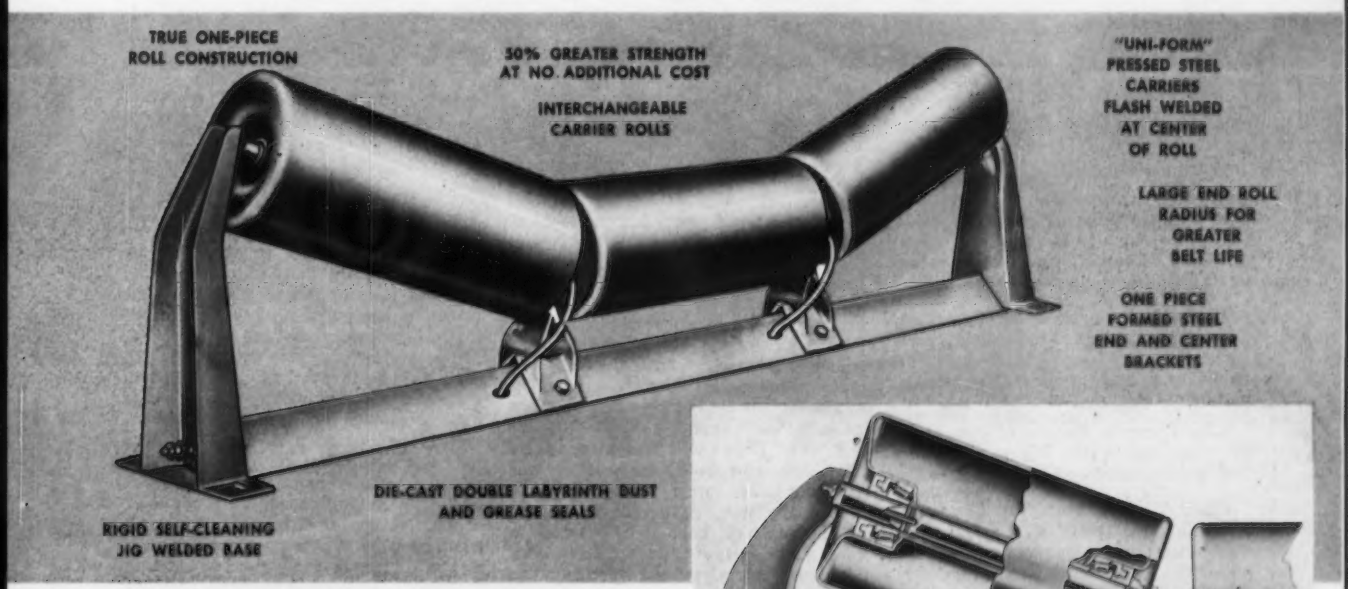
Both ends of rolls equipped with double labyrinth grease fingers, dust seals and anti-friction type tapered roller bearings. Steel through shafts extend throughout length of each roll.

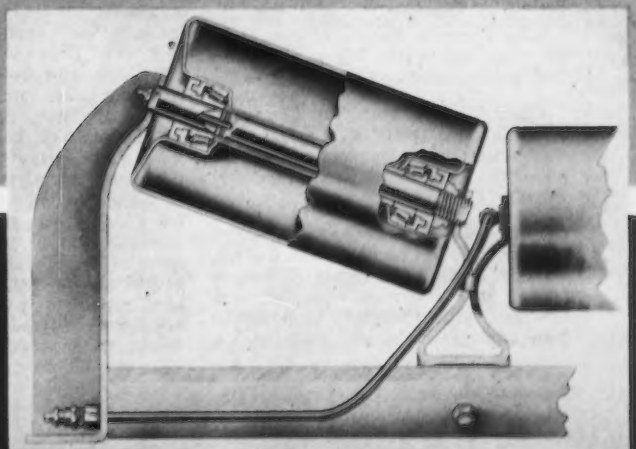
Carrier Rolls mounted as a unit with two outer rolls set at 20° angle to center roll. Each Idler unit mounted on rugged steel support at inverted angle which prevents material from fouling rollers.

UNI-FORM Carrier Rolls are available as stationary or portable, complete units or prefabricated sections.

Let Kennedy engineers show you how the economy and efficiency of UNI-FORM troughing and return Idlers can be applied to your bulk materials handling problem.

Send for Bulletin, D-1002, describing these new, super-strength one-piece carrier rolls for bulk material handling.


TRUE ONE-PIECE ROLL CONSTRUCTION
50% GREATER STRENGTH AT NO ADDITIONAL COST
INTERCHANGEABLE CARRIER ROLLS
"UNI-FORM" PRESSED STEEL CARRIERS FLASH WELDED AT CENTER OF ROLL
LARGE END ROLL RADIUS FOR GREATER BELT LIFE
ONE PIECE FORMED STEEL END AND CENTER BRACKETS
DIE-CAST DOUBLE LABYRINTH DUST AND GREASE SEALS
RIGID SELF-CLEANING JIG WELDED BASE



CUT-AWAY VIEW shows one piece, "UNI-FORM" roll construction with tapered roller bearing and double labyrinth grease and dust seal assembly positioned on both ends of each roll shaft in a housing formed as an integral part of each roll. Heavy duty, tapered roller bearings, for both thrust and radial loads, are securely held in position. The entire assembly is easily accessible with positive bearing adjustment and locking nut. The inner lip of the bearing-seal housing is contoured to form a lubrication reservoir. In relubrication, the grease flows outwardly through the bearing and seal.

KENNEDY-VAN SAUN

Manufacturing and Engineering Corporation • Two Park Avenue, New York 16, N. Y. • Factory: Danville, Pa.

PERSONALS *(Continued)*

ferred as superintendent, Book iron mine, Crystal Falls, Mich.

S. W. Kuchta, mining engineer, Danube iron mine, Pickands Mather & Co., has been transferred as special operating engineer, Erie Mining Co., Aurora, Minn. **T. R. Erspamer,** assistant mining engineer, succeeds Mr. Kuchta.

Emmett Caughlin, superintendent, Corsica mine, Pickands Mather & Co., retired recently after 33 years of service.

George W. Chamberlin, and his wife, were honored at a dinner party on the occasion of his retirement as chief engineer of the Cuyuna Range, Pickands Mather & Co. **Del Carlton,** named to succeed Mr. Chamberlin, presented him with a complete fishing outfit.

Odin A. Sundness, vice president and general manager, iron ore mines, Snyder Mining Co., has retired after 44 years with the company. **A. L. Fairley Jr.** succeeds Mr. Sundness. **Charles O. Rudstrom,** with the company since 1917, has been named general superintendent in charge of the Mesabi Range.

Thomas S. Craig has been named vessel agent at the Soo, and **Wayne S. Spring** has been named manager of the Soo warehouse, Pittsburgh Steamship Div., of U. S. Steel Corp.

George F. Fansett, mining engineer with the Arizona Bureau of Mines, University of Arizona, for the past 39 years, has retired. He was with Cerro de Pasco Mining Corp. in Peru before joining the University.

M. A. Jackson, chief chemist, Great Falls, Mont., reduction department, Anaconda Copper Mining Co., has been promoted to research engineer for the department.

Gust Weggum, mechanical consultant, Minnesota operations, The M. A. Hanna Co., has retired after 50 years of service.

Elmer T. Lang, American Brass Co., alternating for **Russel B. Caples**, president, Anaconda Aluminum Co., has joined the Aluminum Producers Industry Advisory Committee.

Warren G. Steel, assistant professor of geology, North Carolina State College, Raleigh, N. C., has resigned to become head of the geology department, Marietta College. He was formerly employed by New Jersey Zinc Co. at Austinville, Va.

Robert B. Ford, former geologist, Pickands Mather & Co., Crystal Falls, Mich., has opened his own office in Riverton, Wyo., as consulting mining geologist.

Howard S. Lewis, former president, Parish Pressed Steel Div., Dana Corp., and **Gordon Lamont,** former vice president, Nestle Co., have been elected members of the board of the Beryllium Corp. and its subsidiaries, Beryllium Development, Inc., and Minerals and Mining Corp.

OBITUARIES

Rufus E. Zimmerman, 68, retired vice president and chairman of the research policy committee, U. S. Steel Corp., died June 21 following a brief illness. He first became associated with steel research in 1914 with American Sheet and Tin Plate Co., which later became a part of U. S. Steel. He was made vice president in 1933.

Carlton C. Hascall, 69, mining engineer and manager for the J. M. Longyear iron ore interests in Michigan and Minnesota, died June 1 at Marquette following a brief illness.

William E. McRandle, 75, retired manager of the Yale iron mine, Gogebic iron range, Lake Superior Iron & Chemical Co. from 1908 to 1924, died June 8 at his home in Duluth.

John M. Forbes, manager of Quebec's first gold mine, Siscoe, died recently in Montreal. He pioneered copper mining in the northwestern section, and played an important part in the development of a number of well-known properties in the early '30s.

Clarence E. Moore, 90, well known in iron mining on the Mesabi Range, died June 18 in Duluth, Minn. He had been general superintendent, Pitt Iron Mining Co. operating the Wacootah and Miller mines.

Ralph V. Thurston, 70, former research engineer, Miami Copper Co., and later metallurgist for U. S. Bureau of Mines, Tucson, Ariz., died June 11 at his home in Payette, Idaho, following a long illness.

Martin C. Messner, 57, superintendent of the phosphate plant, Anaconda Reduction Works of the Anaconda Co., died June 1 at Anaconda, Montana. He was a graduate of the Michigan School of Mines.

Edwin A. Russell, 66, vice president and director of the Philadelphia Quartz Co., died June 27 at the Burlington County Hospital, Mt. Holly, N. J., following a heart attack.

David B. Scott, 68, western sales manager, American Potash & Chemical Corp. until his retirement in 1952, died June 20, at his home in Altadena, Calif., following a heart attack. Mr. Scott received his Master's degree in Mining Engineering from Columbia School of Mines in 1911.

Fred Bezotte, 68, mining contractor who explored and developed mines in the Philippines, died recently. He came to the Philippines in 1934 with Marsman & Co., the first diamond drilling firm in the country.

Letters *(Continued from p 4)*

from Mr. Johnson's statement, "It will be desirable for the Commission to plan its uranium procurement program so as to provide for an easy transition to a commercial market", that a change in policy of buying ore upon the termination of the present ore-buying schedule might be under consideration.

It is, of course, essential to recognize that the present ore buying schedule was designed to encourage widespread prospecting for small scattered deposits of uranium and to make it economical to mine and ship low-grade ore from such deposits. Obviously, it has served and no doubt will continue to serve the purpose for which it was intended. It would be reasonable to assume, though, that it provides those mining large deposits an excessive profit compared to those mining small deposits. For this reason, the Commission might reasonably consider that a change in the schedule would be advisable upon the termination of the present schedule.

It is also essential to recognize that it is apparently the will of Congress that additional milling capacity be provided by private capital. Therefore, the Commission has no other alternative than to continue its present policy of negotiating contracts with private interests for the processing of the ores purchased under the present ore-buying schedule. This, of course, makes it impracticable to establish a fixed price for uranium concentrates to run concurrently with the present ore buying schedule, due primarily to the wide variation in the cost of producing uranium concentrates in existing plants and of processing ores of varying metallurgical characteristics and grade.

There does not seem to be any evidence to indicate that the Commission contemplates side-tracking any policies which have accounted for the phenomenal success in developing a domestic uranium industry of major importance to the national security merely to provide for additional milling capacity. As a matter of fact, it appears from Mr. Johnson's comprehensive and commendable discussion of the problems involved as a whole that the Commission is not likely to adopt any policies which might prove detrimental to those who have pioneered in the development of the industry.

Surely those in the mining industry who have been initiated into the complexities involved in the milling of custom ores of varying grades and metallurgical characteristics and also planning the most economical scale of milling operations commensurate with potential ore reserves fully realize that the problem is not susceptible of an easy or quick solution. Obviously, though, the problem is in good hands, and undoubtedly, based on all evidence to date, the Commission can and will effect an objective solution without the aid of a commission as suggested by Mr. Wilson in the May issue.

Samuel J. Burris Jr.
Pueblo, Colorado

CABLE AND MINE EXPERIENCE enable Anaconda to design and build shovel cable that resists razor-sharp rocks, water, sun, heat, cold, and — most important — run-overs.

This cable was "built" in our mines to perform better in yours

If you were a cable manufacturer as well as a miner, you could use your mine experience to build cable better than others.

But since you aren't, it will pay you to buy your cable from Anaconda—who *is* both cable manufacturer *and miner.*

FOR SHOVEL CABLE

Years of mine experience . . . of cable testing and improving . . . have taught us how to make a cable that *stays on the job longer under all conditions.* It's Securityflex* Type SH-D cable.

New, job-tested, high-grade butyl insulation assures better resistance to heat, water and compression. And new neoprene jacket makes this cable even tougher and more abrasion-resistant.

For Type SH-D, *or other shovel cable,* let Anaconda mine and cable experience pay off for you. See your Anaconda Distributor. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y. 55321

*Trade Mark

ANACONDA®
MINE CABLE

FLAT-TWIN CABLE

Improved stranding, new insulation, new grounding wire, and neoprene jacket make this a superior cable for shuttle cars, continuous miners, loaders, drill trucks, cutters.

POWER CABLES

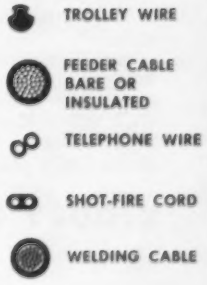
AnacondA Types W & G are rugged, sturdy and long-lived. Used for mine power, shovels, continuous miners, loaders, drill trucks, cutters.

SHOVEL AND DRILL CABLES

Securityflex* Types W and G are used with small shovels, self-propelled drill trucks, pumps and a-c mining equipment. For higher voltages, Type SH cables (shielded) are recommended.

SECURITYFLEX CORDS

Unexcelled for strength, wear resistance and long life. Type SO (heavy-duty) provides superior service on remote control and hand drills.



Note the stringers of Stoody 21 which act as "buffers" between abrasive earth and bucket sides. Inside surfaces of bucket receive similar protection.

All Buckets Take a Beating... Here's the Medicine!

We're often asked about bucket maintenance, what hard-facing material to use and how to use it for maximum wear protection. Actually, your own equipment gives you part of the answer. Each bucket wears differently, depending upon how it is used and the kind of material handled. By watching for development of wear patterns, then hard-facing these areas at definite intervals, you'll get extended service with greatest economy. *Remember, a frequent touch-up is better than a major repair*...more economical in hard-metal and less costly in down time.

If buckets are severely worn, first build up with Stoody Manganese. For hard-facing, the alloy most commonly used is Stoody 21, preferred because of good wear resistance, fast deposition rate and low price. Occasionally, under conditions of excessive abrasion, Coated Tube Stoodite gives longer life on shovel teeth and reduces maintenance costs.

Full particulars on alloy recommendations and hard-facing procedures are in the Stoody HARD-FACING GUIDEBOOK. Ask your dealer for a copy (check the "yellow pages" of your phone book) or write direct.

Bucket teeth (top illustration) and adapters (above) are amply coated with Stoody 21. Hard-faced teeth on this job averaged two full shifts of extra service before needing additional hard-facing treatment.

These Stoody 21 beads across the bucket resist severe abrasion as it is dragged across rubble, returning for a new bite.

Lips on this clam shell are kept in good shape for a tight seal with Stoody 21.

Scoop lifts often lead a tough life. Here, lips, sides and bottoms are kept in good condition with Stoody 21. Occasional touch-ups are made as wear occurs.

STOODY COMPANY 11940 East Slauson Avenue, Whittier, California

Lagging Public Construction — A Spreading National Blight

The most recent editorial in this series dealt with the plans of American industry for expanding and modernizing its plant and equipment over the next four years. These plans call for the expenditure of $113 billion over that period. There is a good prospect that the money to carry them out will be available. If the plans are carried out, manufacturing capacity at the end of 1958 will be double that which existed at the end of World War II. And this industrial plant will be modernized.

In sharp contrast to this picture is the condition of our *public* plant and equipment — the roads, schools, water supply, health and sanitation facilities upon which industry, as well as the average family, depends. **According to a recent estimate by the Twentieth Century Fund, the people of the United States must spend almost $100 billion on new public works projects during the next five years merely to meet the minimum needs of our growing economy.**

Other estimates by the President's Council of Economic Advisers, by state agencies and by private construction economists all show the same condition: a staggering need for public works. Yet no steps have been taken that even offer a promise of closing the gap between the public facilities we are building and the greater facilities we really need.

How did we come to let our public facilities fall into this sorry state? Here are some of the reasons:

(1) During the years of depression and war, from 1930 to 1945, these facilities were neglected. New construction declined, and even maintenance was cut.

(2) Since the end of World War II, increased construction costs have made it difficult for communities to get the needed construction with the funds budgeted in the past for that purpose.

(3) The great postwar upsurge in population, and the spreading of our population into new areas, has created a huge demand for additional community facilities before the neglect of earlier years could be made up.

Responsibility Divided

Now the need for more public construction has become apparent to everyone, on jammed highways and in over-crowded schools. But, unfortunately, the responsibility for doing something about this situation cannot be so clearly fixed as can the responsibility for maintaining industrial facilities. A business firm must expand its capacity when markets are growing or lose its trade position. It must modernize its plant and equipment or be undersold by more efficient competitors. In the case of public facil-

ities, there is no such competitive incentive. To be sure, a city or state may lose population and industries if its public facilities are inadequate. But such shifts are very slow to take place and difficult to relate to any specific public program, or lack of it.

Moreover, the responsibility for constructing public facilities is divided between state and local governments and federal authorities. Within each of these governmental units there are specialized bureaus or departments with varying responsibilities. This division of responsibility obviously adds an element of difficulty to the development of an adequate program of public construction.

Breaking the Log-Jam

How can this administrative log-jam be broken and the financial difficulties overcome?

One course would be to have the federal government step in with a nation-wide new program of direct spending on public works. That would utilize the resources of the federal treasury for immediate action. But there are weighty objections to such extensive federal participation. One is that federal spending cannot be greatly enlarged without a corresponding increase in the federal control of decisions that normally have been left to local communities. Another objection is based on the fact that so long as we must maintain a large defense establishment, such an addition to federal spending means either higher taxes or a chronically unbalanced budget.

The other course is to rely primarily on local initiative, but with new and more effective federal aid to local governments. Such aid would help speed up planning and construction, and contribute toward a solution of the most burdensome financing problems, but in amounts sufficiently limited to require that most of the capital be raised locally.

No Single Formula

No one formula can be applied to make such aid effective. The raising of funds for new schools, for example, involves problems very different from those of financing highways, or water-works, or hospitals. But it does seem clear that, in all these fields, the federal grants must be designed to stimulate more local planning and financing than has prevailed in the past. Among the new ideas that may offer such incentives are federal grants for planning and initial costs and federal guarantees of local bond issues. Such aids have been remarkably effective in the fields of slum clearance and public housing.

While the federal government clearly has a role to play, we cannot afford to postpone inauguration of an adequate public construction program while we seek a formula to apportion governmental participation that would be generally accepted as ideal. Every year about 2½ million more Americans are putting increasing pressure on a public plant already dilapidated and inadequate. The result is an increasing menace to comfort, health, education and safety. It is also an increasing menace to the effective performance of American industry.

The appropriate public response to this situation is a driving public determination to eliminate this increasingly dangerous lag in public construction. At this juncture, the development of such a determination is basic. Nothing stands in the way of an adequate program of public construction that a determined electorate cannot remove.

This message is one of a series prepared by the McGraw-Hill Department of Economics to help increase public knowledge and understanding of important nationwide developments that are of particular concern to the business and professional community served by our industrial and technical publications.

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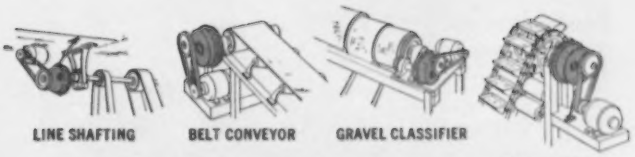
Donald C. McGraw

PRESIDENT

McGRAW-HILL PUBLISHING COMPANY, INC.

Falk ALL-STEEL Shaft Mounted Drives

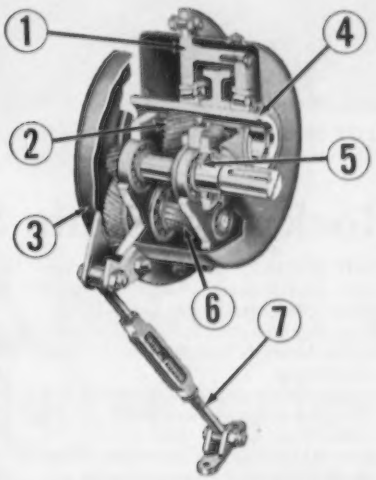


APPLICATIONS UNLIMITED

The range of applications to which the all-steel Falk Shaft Mounted Drive is ideally suited is so wide that complete listing is impracticable. The sketches above are included only to indicate a few typical installations where considerable speed reduction in limited space is an important advantage.

SIX SIZES

- 1/2 to 30 hp
- Single or double reduction
- Wide output speed range—420 to 10 rpm



These versatile, NEW speed-reducing units

save space, power, material and time

Here is the economical solution to the countless application problems requiring efficient speed reduction in limited space! The new Falk all-steel Shaft Mounted Drive—a modification of the universally-accepted Falk Motoreducer design—embodies many exclusive structural and functional features which add up to better service, longer life and substantial savings.

This rugged, compact drive mounts directly on the driven shaft—a distinct saving in floor space. Its precision Falk helical gearing gives highest mechanical efficiency, with a resultant power saving. No adjustable motor bases or slide rails are required. Installation is simple and rapid—output speeds can be quickly changed; thus time is saved...Write to Department 247 for engineering bulletin, including selection and dimension details.

FALK "In-Built" Factors... that give maximum efficiency, convenience and dependability

1 **All-steel Frame,** with more than double the rigidity of iron, supports all rotating elements.

2 **Precision Helical Gears,** designed and machined by Falk, rated to AGMA standards.

3 **Pressed Steel Housings,** whose sole function is to keep oil in, dirt out; easily removed for gear inspection without dismounting unit.

4 **Through Hollow Shaft** with counter bore provides for easiest installation or removal from driven machine shaft extensions.

5 **Backstop** can be furnished with the unit or added later for positive prevention of reverse rotation.

6 **Positive Lubrication,** continuous direct dip of revolving elements at all speeds.

7 **Tie Rod** and turnbuckle serve as anchor and facilitate V-belt or chain adjustment.

THE FALK CORPORATION, Milwaukee 8, Wisconsin

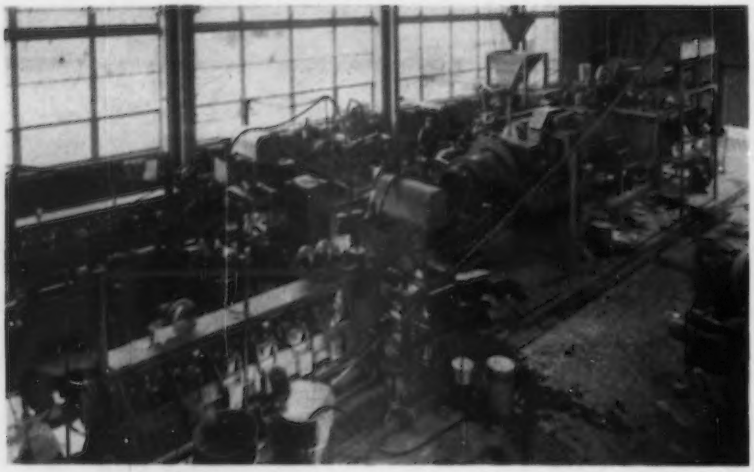
MANUFACTURERS OF

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining

FALK

...a good name in industry

THIS MONTH IN MINING



PILOT PLANT at Kennecott's research center, Salt Lake, is one tour highlight. The leach-precipitation-float process used at Ray Mines division was developed here.

Rocky Mountain Sessions Set

UTAH SECTION, AIME, will be host to the second annual Rocky Mountain Minerals conference, Salt Lake City, Oct. 6-8, holding the meetings simultaneously with the Minerals Beneficiation Division of the Institute.

And, promises the committee, that's all that will be simultaneous. There will be no scheduling of any one of the five sessions at the same time as another. Thus, the Rocky Mountain group will tackle one of the major complaints of the average convention-goer.

Technical sessions on uranium, control engineering in beneficiation, chemical refining of tungsten, rare metals, phosphate processing, materials handling, grinding and crushing, management planning and mining will be held Thursday, Friday and Saturday morning.

Seven field trips are planned, including one to the Kennecott pilot plant, and arrangements have been made for trains to Las Vegas for the Mining Congress meeting. Speakers will include Hon. J. Bracken Lee, Governor of Utah, and William W. Mein, vice president and director, AIME.

Luncheons, cocktail party and dinner-dance, fashion show, tours, and the traditional Scotch Breakfast are also on the schedule prepared by Jack M. Ehrhorn, chairman of the Utah section; Neil Plummer, vice-chairman; Norman Weiss and R. C. Cole, conference-co-chairman; and Mrs. Max Kannard, Women's Auxiliary chairman, Utah section.

True Nuclear Power Cost Data Due In 1960

IF THE PRESENTLY PLANNED six power generators, with their total 700,000 kw capacity, go beyond the paper stage, U. S. will have actual construction costs, power capacities, fuel life and operating cost data by 1960-1963. These six full-scale projects by both Government and private industry will give data on six different types of reactors and will cost about $250-million. 15% of the cost will be borne by the Government.

Duquesne Light Co., Pittsburgh, will build a pressurized water reactor. Consolidated Edison of New York will also build a pressurized model. The other groups with projects covering different methods are: Commonwealth Edison, Chicago; Detroit Edison; Yankee Atomic Electric Co, a combine of several New England companies; and Consumers Public Power District of Columbus, Neb.

It will take several years of plant operation before the six methods can be compared. It is hoped that all the plants will have operatings costs that can be compared favorably with those of some very old peak load stations now being operated by the companies involved.

In making the above announcement, Louis H. Roddis Jr., deputy director, Division of Reactor Development, AEC, also said 5,000 trained engineers are now working on atomic reactions as against 50 in 1947.

Three experimental reactors are now under construction by AEC: the sodium graphite reactor at Santa Susana, Calif.; the homogeneous reactor experiment No. 2, at Oak Ridge; and the boiling water reactor at Argonne. Consideration is also being given to the construction of the organically moderated - liquid metal - bismuth uranium fuel reactor.

Mining Calendar

International Conference on Peaceful Uses of Atomic Engery, sponsored by the UN, Aug. 8-20, Geneva, Switzerland.

Western Area Development Conference, Sept. 8-9, Multnomah Hotel, Portland, Ore.

Southwest International Mining Association and New Mexico Mining Association. Sept. 29-Oct. 1, El Paso.

AIME Rocky Mountain Minerals Conference and fall meeting of MBD, Oct. 6-8, Salt Lake City.

American Mining Congress 1955 Metal Mining and Industrial Minerals Convention, Oct. 10-13, Las Vegas.

University of Minnesota Fourth Annual Drilling Symposium, Oct. 13-15, Minneapolis.

37th National Metal Congress Exposition. Oct. 17-21, Philadelphia.

MAIN SHAFT at Hartbeestfontein gold mine, Klerksdorp, which began production in July with an initial milling capacity of 50,000 tons a month. Mine development, under technical management of Anglo-Transvaal Consolidated, was only begun in November.

These Jeffrey welded steel slatted pulleys keep gritty or sticky material from damaging belts. Wide crossbars give good belt traction . . . . rounded edges prevent gouging. Cone under-structure assures constant self-cleaning.

Welded steel slatted pulleys give conveyor belts "9 lives"

Conveyor (and bucket elevator) belts die fast when abrasive or sticky materials lodge between them and the pulleys. Jeffrey welded steel slatted pulleys eliminate these trouble-makers, greatly extending belt life.

These pulleys will not build up substances that cause belt fabric damage and misalignment as when solid face pulleys are used. Their cone design discharges run-offs from the belt before damage is done. Not only are *belts saved*, but the slatted pulley outlasts the solid face pulley as well!

Because of this self-cleaning action, Jeffrey welded steel slatted pulleys are real money-savers in such industries as stone, sand and gravel, clay, chemical, foundry, iron, slag, metal and coal mining, and wood.

Wide range of sizes

They are available in standard sizes of 12" to 42" diameter and 8" to 42" face width (other size combinations on request). Write today for a quotation on your needs.

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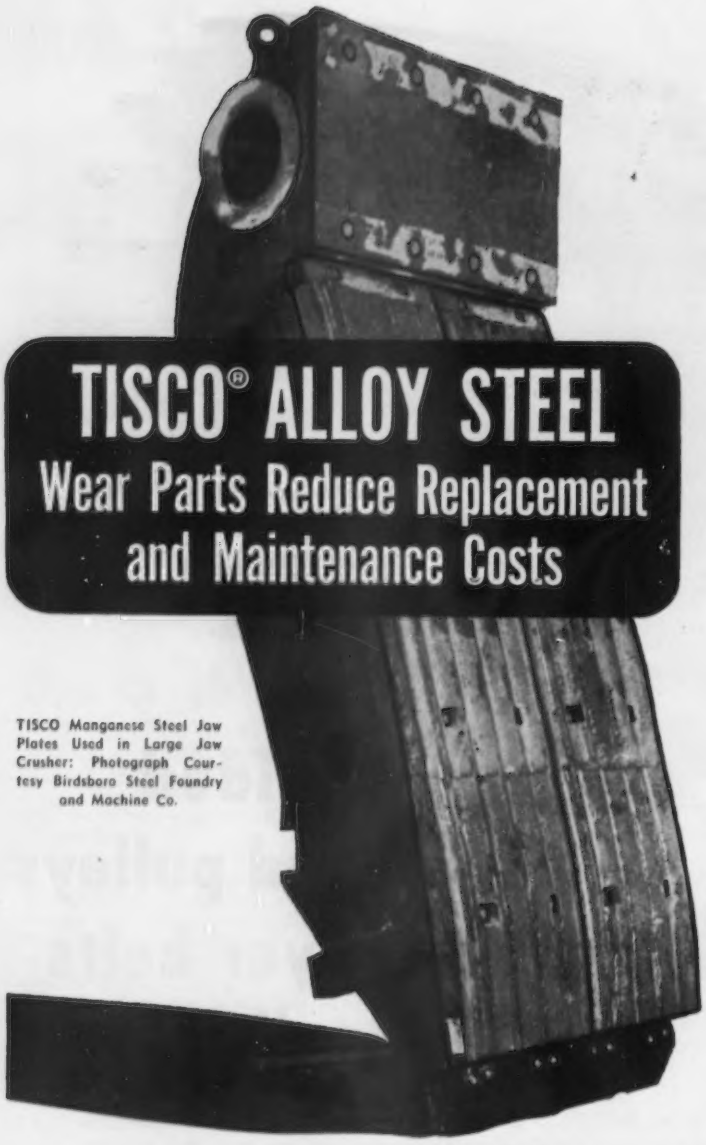

TISCO® ALLOY STEEL
Wear Parts Reduce Replacement and Maintenance Costs

TISCO Manganese Steel Jaw Plates Used in Large Jaw Crusher: Photograph Courtesy Birdsboro Steel Foundry and Machine Co.

For more than seventy years Taylor-Wharton has specialized in alloys that resist impact and abrasion. As the pioneer producer of high manganese steels in the United States, the Company has always been closely identified with this material. More recently Taylor-Wharton has supplemented its line with other alloys of outstanding characteristics, to better cover a wider range of application requirements.

Among these are TISCO 150-Y, a high chrome cast iron, capable of heat treatment up to 700 Brinell. It has strong resistance to severe abrasion, where impact is not a factor. Some outstanding applications are extrusion augers, scraper blades, agitator blades and mixer paddles.

Another useful alloy is TISCO 23-Y, a heat hardenable medium manganese chrome molybdenum steel of excellent abrasion resistance but only fair impact qualities. Hardness can be controlled between 300-500 Brinell. It is widely used for ball and rod mill liners, bushings and similar applications.

Remember—if your problem is impact or abrasion, or both, talk to Taylor-Wharton.

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Birmingham, Ala. Cincinnati, O. Easton, Pa.

Flying Prospectors Find Uranium Area in Alaska

COMMERCIAL GRADE uranium has been discovered in Alaska, according to the Territory Department of Mines. Discovery of the radioactive material was made in May by Don Ross and his wife, Jan, near the southern end of Prince of Wales Island. Area is small, and no ore has been blocked out, but the grade is "definitely commercial."

The Rosses discovered the strong anomally while flying aerial reconnaissance in a Piper Cub, landed and staked a claim. Later, another husband-wife team, Judy and Kelly Adams, were flown in to spend several days setting up camp, conducting radiometric ground surveys, staking claims, etc., with the assistance of the Rosses.

TDM personnel examined the area and found it "promising." A Colorado uranium company was invited to examine the spot and engineers were sent to the property.

American Gilsonite Mines With Jet Water System

AMERICAN GILSONITE CO. will use a form of hydraulic jet mining in exploiting Uintah Basin, Utah, gilsonite deposits. (See *EM&J*, July 1955, p. 73) New firm is a joint affiliate of Standard Oil Company of California and Barber Oil Corp.

Company will let contracts in August for development of its 10-mile-long Cowboy vein near Bonanza, Uintah County.

Roy E. Nelson, production manager, and E. F. Goodner, president, in a description of the proposed mining operation, said the Cowboy Vein will be engineered to produce 600 to 700 tpd of gilsonite.

An 800-ft deep shaft will be sunk on the 20-ft wide vein. Main shaft will contain a high pressure water line connecting with jumbos working in drifts; a 6-in. water flume running to the face of the drift; compressed air lines on which the jumbos will operate; a 30- to 33-in. steel flume running to the bottom of the shaft and up which the gilsonite will move in water solution suspension.

Compressed-air actuated jumbos made by Gardner-Denver Co. will mount a jet "water gun" with a nozzle velocity of 2300 psi. Jet stream tears into the friable gilsonite wall (about 10 ft thick). Gilsonite falls to the floor and is swept up by water pouring through gravity from the 6-in. flume.

Water and gilsonite retreat through a deep "V" notch cut in the drift floor and extending back to the main shaft. A 2% grade is maintained from the shaft to facilitate gravity flow.

At the juncture of the shaft and the drift, the gilsonite-laden water flows into a scupper on top of the shaft flume; then to the pump and crusher station at the bottom of the shaft. Fines and water are separated from any ore larger than ¼-in. Larger ore is crushed to the required ¼-in. size and is then re-united with the

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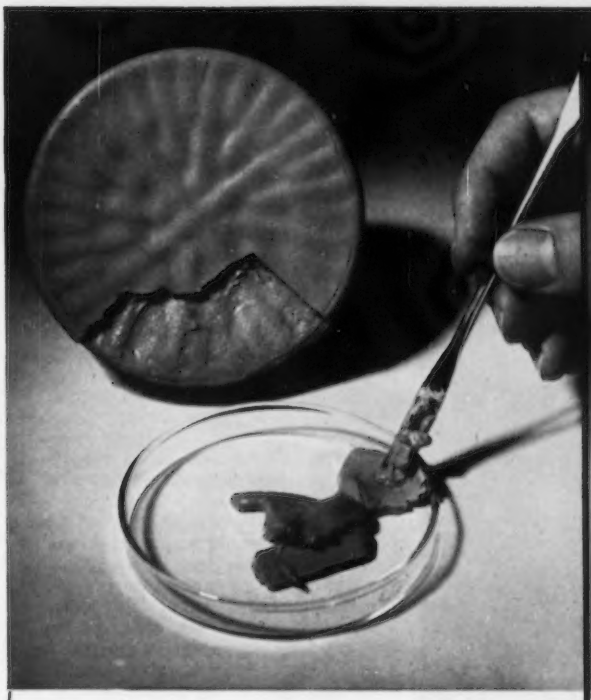

Above picture shows thin cake formed on filter with untreated solids. Cycle includes 15-second cake formation and 45-second drying time.

During the same cycle, a much thicker cake is formed by treating with 0.15 lb. of SEPARAN 2610 per ton of dry solids present.

New flocculating agent speeds up filtration and settling rates, brings many other improvements to liquid-solid separations

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Jet Water System *(Continued)*

water and fines in the surge tank and pumped to the surface.

On the surface, two or three 30,000 bbl surge tanks will be maintained, both for reserve for the 80-mile pipeline leading to the coke-refiner in western Colorado and for mixing proper weight of gilsonite with water.

When drifts are about 500 ft from the main shaft, another manway shaft will be sunk in conformance with Utah mine inspection regulations. A main shaft will be sunk every 1,000 ft in compliance with these regulations.

Water for the pipeline, mine operations and surface installation will come from the nearby White River. 300 gpm will be required.

When lateral drifting is completed to the prescribed length, the jumbo will be moved back to the main shaft and mining on a 1-ft deep cut recommenced.

Miners will work in "near 100% humidity" eliminating the danger of explosion. Gilsonite is an "almost perfect dielectric" and passage of air over it, alone, tends to create an electrostatic condition.

(The firm had been using a compressed-CO_2 cartridge in breaking away gilsonite in the Bonanza vein.)

At every 50-ft of depth, AGC will place solid wood flooring to protect miners below from falling rock or ore. At about every 300 ft, a pillar of ore will be left.

The cutting of initial drifts will start about 70 ft below the top of the vein.

One major pumping station will serve the 8-in. pipe line carrying the gilsonite in suspension to the coke-refiner. At the refinery, the gilsonite-water slurry will go through a dewatering process, consisting of flotation cells, filters and thermal driers. Gases produced in delayed-cooking will be used in part to dry ore.

The dried ore will then be liquified by mixing it with hot, heavy recycle gas-oils and raised to a temperature of 550 deg F.

From the melter, the gilsonite will be fed to heaters in a delayed coke unit. Products are metallurgical grade coke which will be sold to the Pacific Northwest aluminum industry for electrodes, gasoline fractions and high gas.

The gasoline fractions will be processed in a two-stage catalytic reformer—unique because it does produce enough hydrogen to satisfy the treating requirements.

Consequently, some hydrogen will have to be produced from the process to make up the deficiency. The hydrogen is needed to remove the nitrogen ions from the gasoline fractions. An ammonia product results from this union.

Gasoline, after reforming, will be finished and blended and distributed to dealers in Utah and Colorado.

AGC has said in effect that it is gambling $10-million that the 16-million tons of gilsonite it controls (equal to 100-million bbl of oil) can be produced in economic competition with oil from wells bored into the ground.

It believes its metallurgical grade coke can out-compete the petroleum coke ends produced by west coast refineries and sold to the aluminum industry.

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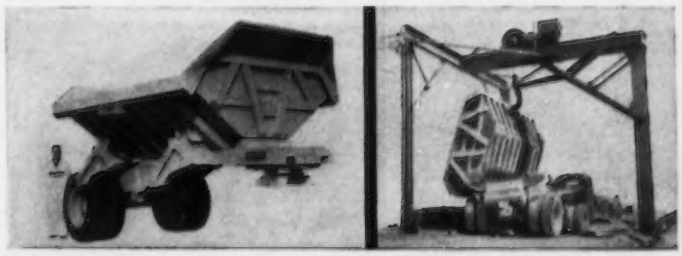

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ARIZONA

Nic-L-Silver Battery Manufacturing Co. will build a battery-making plant at Phoenix, Ariz., around the first of the year, according to C. George Lippincott, company founder and president.

Lippincott, of Santa Ana, Calif., owns and operates the Lippincott Lead Mines in the Panamint Mountain range of Death Valley, Calif. They produce the lead and silver used in his battery operations.

Military will open the Muggins Mountains area in Southern Yuma County for uranium development. Mountains are on the edge of the Yuma Army Test Station and contain about 300 claims. Area is in the safety zone for the test station's artillery range.

CALIFORNIA

Ownership of the Miracle Mine has been transferred from M. William Ditto of New York City to Miracle Springs Mining Corp. as a prelude to full-scale operation of the million-dollar uranium property in Kern County.

Voting stock in Miracle Springs Mining Corp. is owned by Wyoming Gulf Sulphur Co. Ditto, a consulting engineer, purchased the 400-acre mine property last September for $1-million, paying the original discoverers $35,000 down and agreeing to pay the balance out of royalties at 12.5%.

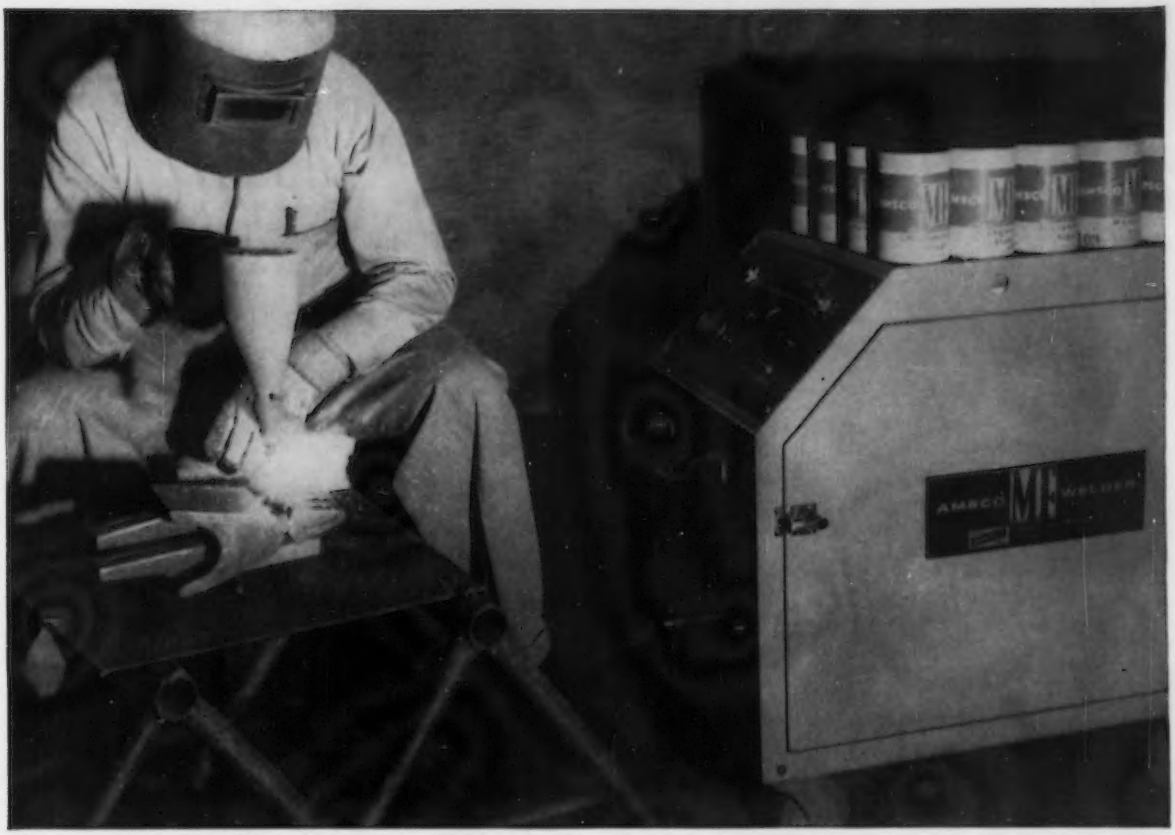
Stewart Patterson, mine manager, has applied for clearance from the Atomic Energy Commission to make another carload shipment from ore stockpiled at the mine. In July 1954 the Miracle Mine was credited with the first carload shipment of uranium ore from California.

A 12-man crew is digging new location holes on the property's original 20 claims as an aftermath to restaking of the claims at 10 am, June 3—deadline when the land was restored to the public domain after being withdrawn some 30 years earlier for power development purposes.

First uranium mill on the West Coast is scheduled to go into operation around the middle of September on the Mojave Desert.

Verdi Development Co. will operate the mill, which is nearing completion on a 33-acre mill site near Soledad Mountain, 4 miles south of Mojave in Kern County. Verdi is adapting the Beck gold mill, which was acquired earlier this year, into a uranium milling and leaching plant, with cost of the conversion program approximating $150,000.

Capacity of the new mill will be 50 tpd ore. Mill is a "pilot plant," with plans calling for eventual expansion of capacity to 250 tpd. If and when the mill is enlarged, it will probably be operated as a custom mill. For the present, Verdi plans to mill only its own ore. The company plans to stockpile approximately 6,000 tons of ore before putting the plant into



Welder is shown welding a "wear-sharp" repointer to the shank of a dipper tooth using the Amsco MF and flux.

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Cost of deposited metal is less! The Amsco MF uses coiled, bare mild steel electrode. It feeds through the flux hopper (the cone). There it is magnetically coated with your choice of manganese steel build-up or hardfacing alloy which is carried in the flux. You coat your electrode as you weld at considerable savings in deposit cost.

The machine is portable. It plugs into any standard welding unit, and requires no special setup. See a demonstration of the Amsco MF's speed, quality of weld and uniform deposit. Try it yourself and discover how easy it is to operate. Your Amsco Distributor is ready to show it to you now. Welding products are distributed in Canada by Canadian Liquid Air Co., Ltd.

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California *(Continued)*

operation. Verdi owns approximately 2,200 acres of claims near Rosamond, 12 miles south of Mojave.

Principal components of the mill include a crushing and grinding section and conditioning tanks. Sulphuric acid will be used for the leaching process. End product will be sodium uranyl sulphate.

A six-man crew is working to complete the mill under the supervision of Dudley E. Cornell, metallurgist and plant superintendent. Cornell is a graduate chemical engineer and geologist who came to Mojave recently from Farmington, N.M.

Victory for management of Yuba Consolidated Gold Fields in a proxy race was upheld when results of an independent audit were announced at a June 22 meeting in Portland, Me.

President Marshall G. Bolster and his slate received proxies for 1,062,305 shares. Benjamin E. Pitman Jr., San Antonio financier, garnered 1,030,984 votes for his slate.

The annual meeting, which convened June 9, was adjourned until June 22, when the independent vote count was announced.

Outcome of the proxy fight was reelection of the entire board of directors.

Yuba, whose principal gold dredging properties are in California, has its operating headquarters in San Francisco, headed by Ernest J. Gorman, general manager.

COLORADO

New figures in the uranium industry are the millionaire Murchison brothers of Dallas, Tex., who with their associate Sid Richardson have purchased a major interest in the Thornburg uranium properties near Gunnison.

The Thornburg-Murchison-Richardson alliance is known as the Gunnison Mining Co. It is incorporated in Delaware.

The Thornburg property involved consists of the 32 Los Ochos claims, in Saguache County 22 miles southeast of Gunnison. Thornburg brothers, Garth and Vance, purchased the group last summer for $100,000 and began shipping pitchblende-type uranium ore to Salt Lake City in March.

The Murchison-Richardson combine has bought a 50% interest in the property, Vance Thornburg said.

Clint Murchison said a $500,000 exploration program would be started immediately, to completely block out the orebody. Estimates on value of the orebody has ranged as high as $19-million.

Clint Murchison said if enough reserves are found negotiations for mill permit will be started with the AEC.

Globe Hill Mining Co., driving a 150-ft tunnel on its S & B group of 23 claims in San Miguel County, reported its first ore shipment was ready for the mill in early July.

Summer meeting of the Colorado Plateau section of the American Institute of Mining and Metallurgical Engineers was held at Silverton in June. Papers were read by

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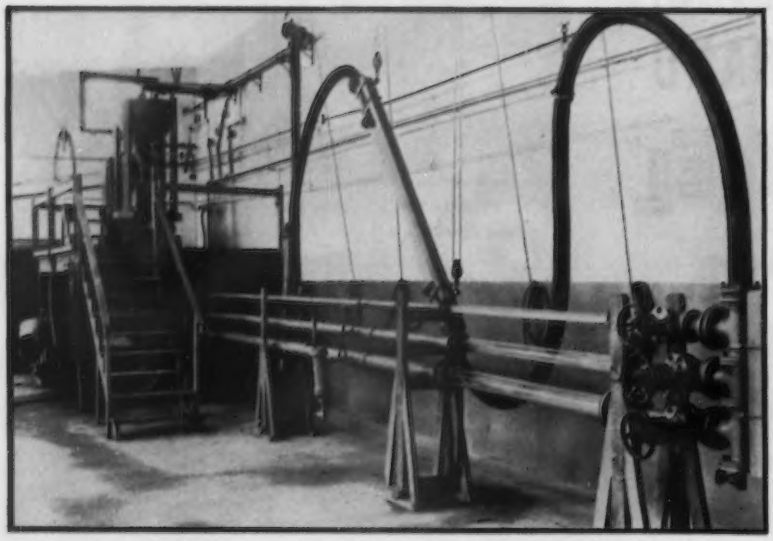

The Morris equipment testing slurry shown here can determine friction losses and critical carrying velocities of any slurry. Customers' samples analyzed here have taken much of the guesswork out of slurry applications, and yielded such answers as these to actual pumping problems:

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ANSWER 2	Proved wide friction differences in very similar materials — saving the customer the time, expense and possible loss of an inadequate pump.
ANSWER 3	Proved that the customer could handle the job by gravity alone — and so required no pumping equipment at all!

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Colorado *(Continued)*

Philip J. Shenon of Salt Lake City, AIME national director; Charles K Rose, chief of the U. S. Bureau of Mines oil shale mining branch for Region IV; and Page Edwards, director of Colorado Plateau operations for the Vanadium Corp. of America.

New Idria Mining & Chemical Co. purchased nine claims in the Gateway mining district in June for $675,000. Sellers were Don and Dorothy Danvers.

The property will be mined for New Idria by the Beaver Mesa Uranium Corp., the new firm formed by merger of Cherokee Utah and Ventures, Inc.

Silver receipts at the Denver mint in May hit an all-time high, mint officials report. Total was 906,985 oz valued at $820,813 compared with 161,118 oz worth $145,731 in May 1954. Previous high was 734,670 oz worth $664,812 in March 1955. Gold receipts in May dwindled to 78,147 oz valued at $2,735,179 from 83,137 worth $2,909,807 in May 1954. The gains in silver are attributed for the most part to larger production as a copper by-product.

Lithium ore reserves of approximately 1½-million tons have been reported by the United States Lithium Corp. on its property in Gunnison County, Colorado. N. G. Morgan, Jr., said new studies of the two properties, the Brown Derby and the Tucker group in the Gold Brick Mining District, indicate "a firm foundation for the company's program of becoming a chemical enterprise." Morgan said a diamond drilling program has been started on the company's properties.

Russell Jewett, Pueblo druggist, and his father, S. A. Jewett, also of Pueblo, have shipped the first load of uranium ore from Marshall Creek in Saguache County, 12 miles south of Salida. Jewett said they had been digging all winter, and have a "couple of hundred feet" of diggings. The Jewetts are employing several local men on the project. The ore was shipped by truck to Grand Junction.

At the Ajax mine of Golden Cycle Corp., at Cripple Creek, a streak of ore has been hit on the New Market vein from the 3,000-ft level grab sampling up to 1½ oz gold per ton. Vindicator lateral is steadily being pushed ahead at the rate of 150 ft per month, with no water struck as yet. According to mine officials, it is just a matter of time until the drift crews strike water and the pace is slackened.

At the Cresson mine, work on the shaft has progressed about 10 ft below the new 2300 level. The work is still in progress. Sinking of the new hundred feet gained is complete except for some timbering. The new 2300-ft station, which is being cut should be completed soon. The Grace Greenwood property is still shipping regularly to the Carlton mill, with the ore averaging .30 to .40 gold to ton. The ore is coming from the stope being worked on the 500-ft level.

Vernon A. Cheever, State Senator of Colorado Springs, vice president of Wet Mountain Mining, Inc., announces that E. W.

United States Rubber Company 4-year project pays off—
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says H. Earl Parker, Marysville, Calif.

"On tough jobs like Pine Flat Dam, we've had a tremendous increase in tire service since we switched to U. S. Royal Nylon Con-Trak-Tors. This has meant a substantial decrease in downtime on heavy equipment and a real economy for us in operating costs."

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The U. S. Royal Con-Trak-Tor, an important result of U. S. Royal's 4-Year Truck Tire Project, is increasing service life and reducing equipment downtime for leading construction men like Mr. Parker.

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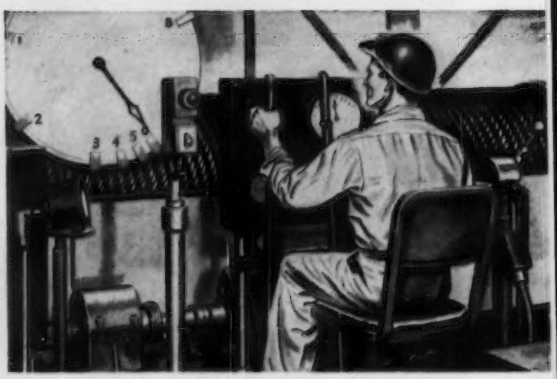

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Colorado *(Continued)*

Ohlson, president, has negotiated an agreement with an eastern company to ship them five tons of thorium concentrate daily. Cheever says the mining concern has a proposal from Associated Engineering, Inc., Denver, for construction of a concentration mill that can be built in about 90 days. The mill site will be on the Tuttle ranch property located 17 miles south of Canon City, Cheever said.

Walter E. Scott, Colorado mining commissioner, estimated in his annual report released July 20 that the uranium industry brought Colorado $118-million in 1954, representing about three-fifths of the total mining economy of the state.

Total Colorado mineral production during 1954 was estimated at $337,213,451, exceeding the previous year by $87,132,811.

At Crested Butte recently the American Smelting & Refining Co. began calling skilled workers to the area to start readying its new, but never-operated Keystone mill for operation. Job specialists on all phases of the operation were brought in from other AS&R properties to get the quarter-million-dollar plant ready to go.

Crown Uranium Co. and Mount Wilson Mining Co. are operating a 150-ton gold, silver, lead and zinc mill at Ouray to custom mill ore from the rapidly reviving Telluride district, it was announced. John G. Obrecht, Casper, Wyo., Crown president, said his company and Mount Wilson will operate the old Silver Shield mill jointly on a lease from Salt Lake City, Utah, interests. The mill is being renovated. In addition to custom milling, the plant will handle ore from Mount Wilson Mining Co.'s long unworked properties on Mount Wilson.

IDAHO

Big floating dredge which Porter Brothers Corp. of Boise and Spokane operated on a gold placer north of Helena, Mont., from 1935 to 1950 is being dismantled and shipped to a new placer location near Boise. At the Helena location the 6-cu-ft, bucket-line dredge handled about 5,300 cu yd of gravel daily with a crew of 18.

Government geologists in Spokane have confirmed reports of a discovery of pitchblende and autunite ore in a pegmatite dike on the east side of Priest Lake in Bonner County about 4 miles north of Coolin.

Big Salmon Uranium Inc., organized recently by Phillip and Clyde Jungert and James Aram, all of Lewiston, is moving in equipment and machinery to start development of a 40-claim uranium prospect on the Big Salmon River along U. S. highway 95 in the Florence-French Creek District of Idaho County. Assays of samples taken from the discovery outcrop reportedly indicate the deposit may yield production worth as much as $500 a ton under selective mining methods.

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Idaho *(Continued)*

shaft-raise on the adit level and is now cutting headroom, rope-raise, station and ore pockets in preparation for installation of the hoist. New shaft, which was raised out from above the offset winze on the 2,000-ft level, will greatly increase hoisting capacity at the property east of Mullan and make possible a substantial boost in production. With only the old, small shaft, output was limited to about 125 tpd.

American Silver Mining Co., whose property in the silver belt of the Coeur d'Alene District is being developed at sea-level depth by Polaris Mining Co., under a profit-sharing agreement, has joined in the search for uranium in both Utah and the Inland Empire area around Spokane, Wash. Five Utah properties, totaling 35 claims, have been obtained under an agreement with Hugh C. Van Valkenburgh & Associates of Seattle, which will finance their development for American Silver stock and $100,000, payable only from 10% of production. Twenty-four of the claims are in the San Rafael Swell area of Emery County, four in Millard canyon, Wayne County, and seven in the Soda Springs basin of the Green River district, San Juan County. First exploration will be done on the Soda Springs claims where neighboring operators have uncovered some promising ore showings.

Company has also obtained prospecting rights on approximately 1,000-acres of state land in Stevens County, Wash., north of the Spokane Indian Reservation where Newmont Mining Corp. is now operating the Midnite uranium mine, the state's first producer, and it has staked a number of claims, jointly with Dinosaur Uranium Co. of Seattle, in the Hall Mountain area of Boundary County, Idaho, where uranium and thorium were discovered recently.

MICHIGAN

Spies mine of the Cleveland-Cliffs Iron Co.—the company's only operating mine in Iron County—is to be closed permanently. Diamond drill operations extending over a period of three years have failed to locate sufficient ore to prolong the life of the mine. Since last February the mine's production has come chiefly from pillars—the last tonnage to be removed from a mine. Spies was opened in 1916 and has operated continuously except for fifteen months in the depression years of 1932 and 1933. About 90 men have been employed at the mine. Some will be transferred to the Marquette range; some will go with other Menominee range operators and some are near retirement.

MINNESOTA

With 3,008,620 tons forwarded during the week ended June 20, Lake Superior area iron ore shipments exceeded 3-million tons for the first week this season. Total shipments as of that date were 23,402,-

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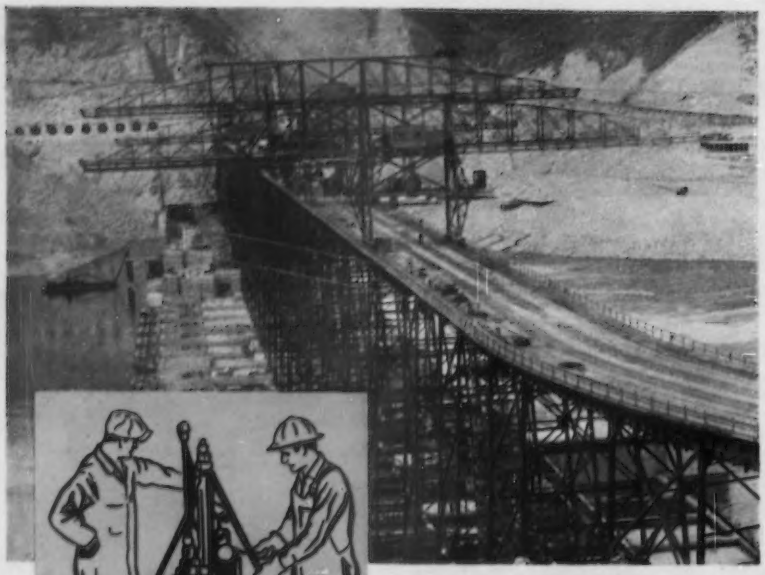

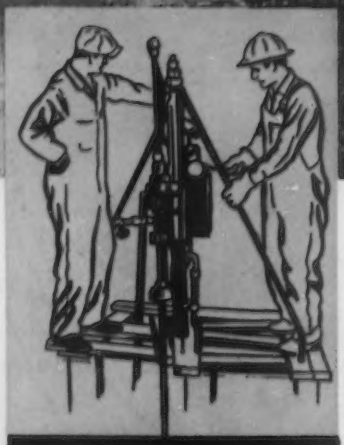

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Minnesota *(Continued)*

638 tons. With 17 weeks remaining up to Oct. 17, which is about the date when washing plants are expected to be slowed down or closed because of freezing temperatures, a maintenance of that rate would produce a total of over 80-million tons for the full season, even if the season ended by Thanksgiving.

Duluth office of Oliver Iron Mining Division announced that its Pilotac taconite plant at Mountain Iron would be open to the public on and after June 28. President R. T. Elstad said that the plant and the company's open pit observation stands would remain open for tourists and visitors through Labor Day. "This season we expect to greet our one-millionth visitor." Observation stands are located at Eveleth, Virginia, Chisholm, Hibbing, Marble and Taconite. Almost 200,000 people visited Oliver's operations last year. More than 10,000 toured the Pilotac taconite plant.

Of the 62,388,824 tons total Lake Superior area (including Canada) shipments for 1954, 15.75%, or 9,829,256 tons, was straight washed ore. Crude ore beneficiated by jigs, high density, sintering, drying, taconite concentration, etc., made up another 10,071,302 tons or 16.15%. Total of beneficiated ore was 19,900,558 tons or 31.90%.

Tabulation included in a report of the Great Northern Railway Co. shows that total shipments for the years 1949 to 1953 inclusive of direct shipping and concentrate ores from the Mesabi range amounted to 321,600,000 tons: an average of 64.3-million tons per year. During that period the total decrease in iron ore reserves, the report states, was 67.2-million tons, or 13.4-million tons per year. This is equivalent to an increase in reserves during these five years of over 264-million tons.

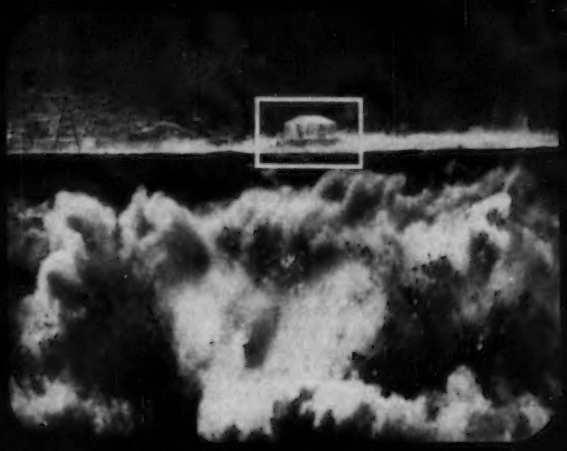
Based on the record of these five years as to average shipments and average additions to reserves, the report concludes that the prospective life of the Mesabi range is 63 years. Taconite is not included. A considerable proportion of the increase in reserves shown is probably due to the inclusion, in recent years, of lower grade crude ores, in estimated reserves, of material that may now, with new processes, be beneficiated.

The prospective life of the Mesabi range, without considering taconite, depends largely on how long concentration plants of the future can continue to accept lower and lower crude ores from which they may produce satisfactory concentrates.

MONTANA

W. B. Tobey, general superintendent of Minerals Engineering Co., which is operating a large tungsten mine and mill near Glen, Beaverhead County, 45 miles south of Butte, says the mill has been increased to a capacity of 800 tpd and plans are underway to increase this to 1,000. Company is shipping its con-

COST-CUTTING MEMOS:



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Montana *(Continued)*

centrates to its own refinery at Salt Lake City. Ninety men are employed at the operation.

Moab Treasure Uranium, Inc., a Utah corporation, is developing the uranium holdings of the Elkhorn Mining Co., known as the Free Enterprise group, located near Boulder, Jefferson County. Hal George, superintendent and assistant manager for the Utah company, is in charge of the work.

Montana State Board of Land and Investments has drawn up for the first time a lease form for prospectors desiring to hunt uranium on state lands. It will cost $2.50 to file an application for a prospecting permit and give a prospector two years to explore, with a possible extension to three years. Rules for the lease form and operating for uranium, especially when shipping ore, are quite lengthy, but new rules and regulations are available free of charge at the Montana Bureau of Land and Investments, Capitol Building, Helena.

Montana Uranium Producers Association was incorporated in Montana as a nonprofit group on June 16, 1955 by T. V. Leonard, John R. Marchi and John T. Vance, all of Helena; E. K. Cheadle and Paul Dawson, both of Billings. With headquarters in Helena, one of the directors states that the association was formed to "assist and advise those interested in prospecting for, developing and mining uranium and other radioactive minerals, and to cooperate with governmental agencies charged with the responsibility of encouraging the development of uranium producing properties."

Basin-Jib Mines, Ltd., of Toronto, Canada, a reorganization of the Basin-Jib Gold Mines, Inc., a Nevada corporation, now is developing the famous Jib gold property in the heart of Basin, Jefferson County, which in 1924 was the largest producer of gold in Montana. Operating company is sponsored by Mentor Exploration and Development Co., Ltd., of Toronto. Denison Denny is president of both Canadian companies, J. Pierdon is vice president and W. E. Field, Box 406, Boulder, is local representative. W. F. Criswell, Boulder, is superintendent. Company has made a contract with Roger V. Pierce, Salt Lake City mining engineer, to sink a three-compartment shaft to a depth of 300 ft.

Uranium ore has been discovered from surface exposures in the Vermillion Creek drainage area of Sanders County about 25 miles northwest of Thompson Falls. Work on the claims is being done by A. Ben Cox, his son, and John Cochran, all of Thompson Falls.

More than 100 applications for uranium prospecting leases which have been piling up in Montana land commission offices for the past 15 months were mailed in June to all parts of the state.

Along with these go 10 metalliferous mineral lease applications being sent to parties who intend to prospect for precious metals and commercial ores.

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CORROSION spreads rapidly when paint was scratched, exposing untreated sheet metal.

DURIDIZED panel which got the same scratch shows how corrosion was prevented from spreading.

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26M

NEVADA

Western Mercury and Uranium Corp. is building access roads and driving tunnels at its property in Nye County and has exposed two exceptional showings of cinnabar. Jim Smith and Lowell Bonnett, of Las Vegas, are owners of the mine which is 10 miles east of Silver Springs, and are starting a new tunnel.

Buckskin Mine near Yerington has been rehabilitated and dewatered, and a $5,000 development program has blocked out of a large section of gold-copper sulphide ore reported to total more than 100,000 tons. Mine, owned by E. F. Schultz, of Yerington, has been under option since midwinter to the Nev-Tah Oil and Mining Co., a Utah corporation. Three lower levels, reportedly rich in sulphide ore, are being sampled, and metallurgical tests are under way in contemplation of construction of a 100-ton flotation plant. Equipment now installed consists of an electric generating unit, compressor, hoisting facilities, pumping equipment, and rock drills. Oscar Herbert, of Dayton, is superintendent in charge of the operations.

Development is going forward at the Mt. Wheeler Mines, Inc. property in northeastern White Pine County. Work has begun on a 6x7 ft tunnel which will bore 6,000 ft into the mountain, and which is expected to cut the St. Lawrence fissure and the Combined Metals Co. bed at depth. The work is being done by the Central Development Co., of Eureka, Utah, with Howard McIntyre in charge. Mine, a producer of lead, zinc and silver ore, was purchased by the present owners from James Hulse and Victor Cottino, of Pioche, and Shirley Robinson, of Ely. The sale price was reported at $20,000.

What is reported as an extremely high grade gold ore has been discovered in the Scossa mining district 65 miles west of Winnemucca by John Etchart and Frank Hardin, lessors of the property. A ledge carrying the ore was opened on virgin ground between the Watson and Dawes shafts on the property. Drifting was started in the 100-ft Watson shaft and has been put forward 100 ft to the Dawes shaft which has been developed to the 450-ft level. Seven men are employed on the property, and construction of a 25-ton ball mill is nearing completion.

Shipment of 100 tons of uranium ore from the Jeanne K and Cornelia C mine near Hallelujah in Washoe County during June brought a return of $6,000 plus $6,000 in bonus money to the six partners in the venture. Ore was shipped to continental Uranium Mining Co., at Grand Junction, Colo.

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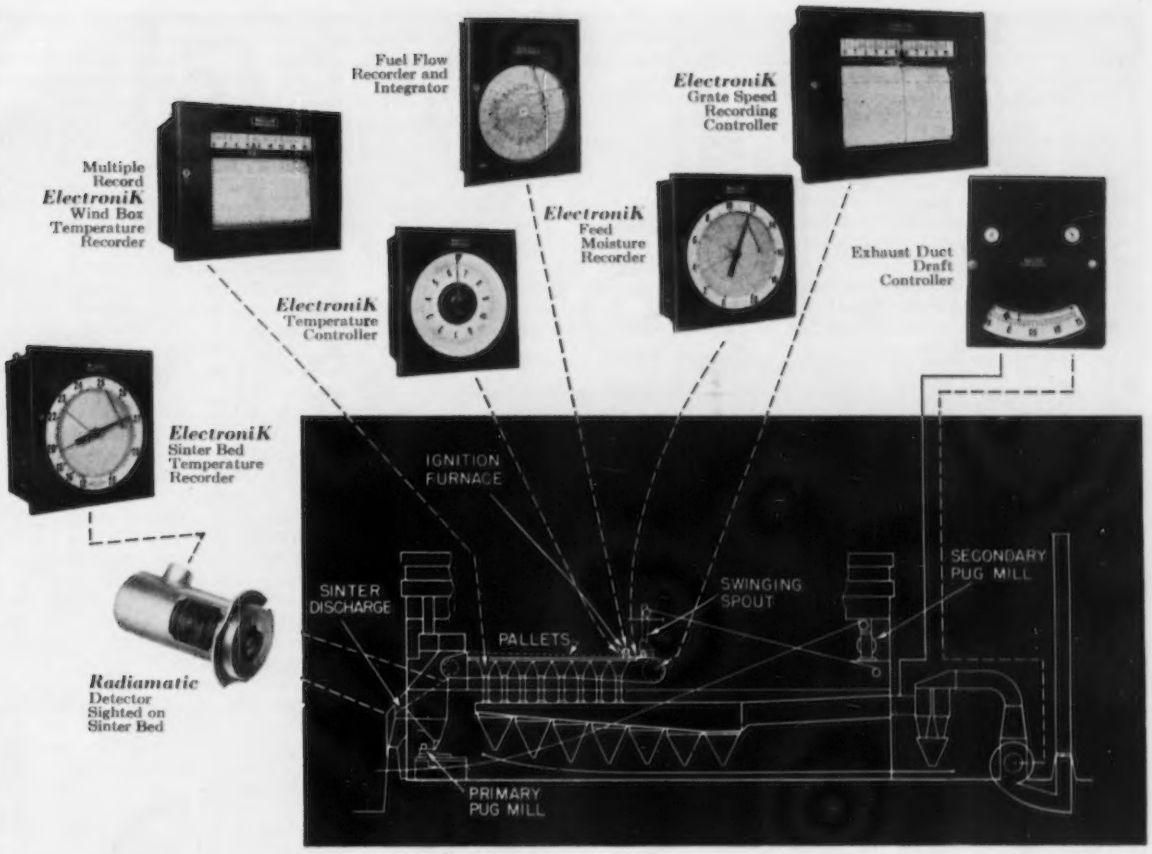
NEW MEXICO

PRINCIPAL SPEAKERS at the dedication of the Kerr-McGee mill at Shiprock were: Sheldon P. Wimpfen, manager, Grand Junction operations office, AEC; Paul Jones, chairman of the Navajo Tribal Council; U. S. Senator Robert S. Kerr; and Dean A. McGee.

A $3-million uranium ore processing plant built by Kerr-McGee Oil Industries, Inc, of Oklahoma City near Shiprock, was opened to the public in colorful ceremonies in June.

The plant, ninth to be built on the Colorado Plateau, has been operated since last December but its formal opening was put off until good weather.

A crowd estimated at around 5,000—made up mostly of Navajo Indians who already are deriving two-fold benefits from the plant—attended the ceremonies.



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THE COMPLEX sintering machines used in modern ore benefication processes demand accurate, automatic control of ore critical variables in order to function at peak efficiency. For the varied requirements of such equipment, Honeywell produces a comprehensive line of instrumentation.

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Wind Box Temperatures . . . a multi-point *ElectroniK* instrument records individual temperatures . . . or individual temperature indications, correlated with wind box suction.

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Sinter Bed Temperatures . . . *Radiamatic* element sighted on bed surface leaving ignition furnace is connected to an *ElectroniK* temperature recorder showing carbon and moisture fluctuation.

Draft Control . . . a Brown Pressure Controller or Flow Controller regulates the exhaust fan to maintain constant draft or air volume.

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● **REFERENCE DATA: Write for Composite Catalog No. 5002 for a condensed listing of all Brown instruments.**

MINNEAPOLIS **Honeywell**

BROWN INSTRUMENTS

First in Controls

New Mexico *(Continued)*

Built on Navajo land, the mill is paying 10% royalties on ore from tribal lands, and in addition has 50 Indians on its payroll.

Speakers included the Oklahoma corporation's two top men: U. S. Senator Robert S. Kerr, chairman of the board, and Dean A. McGee, company president.

Also on the program were Paul Jones, chairman of the Navajo tribal council, and Sheldon P. Wimpfen, manager of the Grand Junction (Colo.) Operations Office of the Atomic Energy Commission.

Wimpfen, who termed the Kerr-McGee plant as a monument to the cooperation of all concerned," predicted that at least one more uranium ore processing plant would be built on Navajo lands.

Kerr and McGee told the crowd that the plant's capacity has been doubled even while it was under construction.

Paying tribute to the Navajo's "proud history," Senator Kerr told them "you also have a great future in helping usher in the atomic age."

Jones expressed the Navajo tribe's gratitude to Kerr and McGee for building the plant "which will contribute to Navajo prosperity." The tribal chairman spoke in both English and Navajo; an interpreter translated the other talks for the benefit of the Indians in the crowd.

Following the talks and a free barbecue, the big plant was opened to the public, except for a few restricted areas.

Kerr-McGee is the first oil company in the U. S. to build and operate a uranium processing mill and one of the few oil firms to mine uranium. The company in May 1952 purchased the Navajo Uranium Co. from its founders and began research into uranium plants along with starting negotiations with the AEC for a contract. Construction began in February 1954.

Mill occupies 160 acres south of Shiprock in northwestern New Mexico. It is unique in its employment of an all-acid process for the production of uranium oxide.

A 16-mile gas line connects the mill with El Paso Natural Gas Co's 24-in. main that carries natural gas from the San Juan Basin's nearby gas fields to California. Water is obtained from the San Juan River which flows less than a mile away.

The mill operates 24 hours daily in three eight-hour shifts. While it is now processing ores which come chiefly from the company's own holdings in the Lukachukai Mountains near Cove, Ariz., it also accepts ores from any uranium mines in the Shiprock area.

The mill currently employs about 100 persons with a payroll of $35,000 a month. The company has erected 20 houses and one three-unit apartment house in Shiprock for its supervisory personnel.

At present, company officials said, the plant will produce no by-products, but later plans to produce crude ammonium sulphate, used as a fertilizer.

The new mill is one of two major industrial ventures—in addition to its oil activities—undertaken in New Mexico by Kerr-McGee. The firm is currently cooperating with the American Farmers Union in the erection of a multi-million-dollar potash plant in southeastern New Mexico.

Spencer Uranium Co. has acquired all the properties and assets of Bee Sho Shee Co., Farmington.

Sid H. Eliason, Spencer chairman, said Bee Sho Shee had 160 acres in Indian permits adjacent to the Vanadium Corporation of America's Monument No. 2 mine —and 40 acres adjacent to Spencer's Yazzie claims.

This last property has been shipping from 30 to 40 tons daily to the Shiprock, Ariz. mill of Navajo Uranium Division, Kerr McGee Oil Industries, Inc., Eliason said.

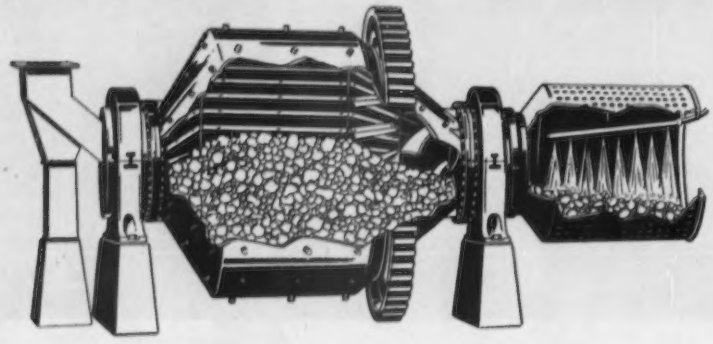
NORTH CAROLINA

Appalachian Sulphides, Inc., is constructing a shaft and buildings in the Ore Knob mining area near West Jefferson, which lay idle for many years until it was purchased recently by R. G. Lassiter.

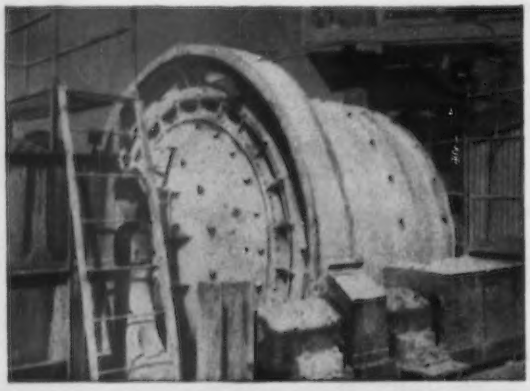
Company, since the first of the year, has been active in exploring, acquiring and developing mining properties in the area.

Contracts have been let for sinking the Ore Knob shaft to 13,000 ft, three homes for management personnel have been started and nine more are planned.

HARDINGE SCRUBBERS FOR PIT-RUN MATERIALS



Large diameter, short length trunnions permit chute feeding of unsized ore and rock at rates up to 600 tons per hour.
The mass loading and ball-mill action in the scrubber quickly and completely slurries the clay and dirt, permitting ready separation on washing screens or trommels.



View of a 10′ x 66″ Hardinge Scrubber cleaning crushed dolomite in a California plant.

Bulletin 37-A-1

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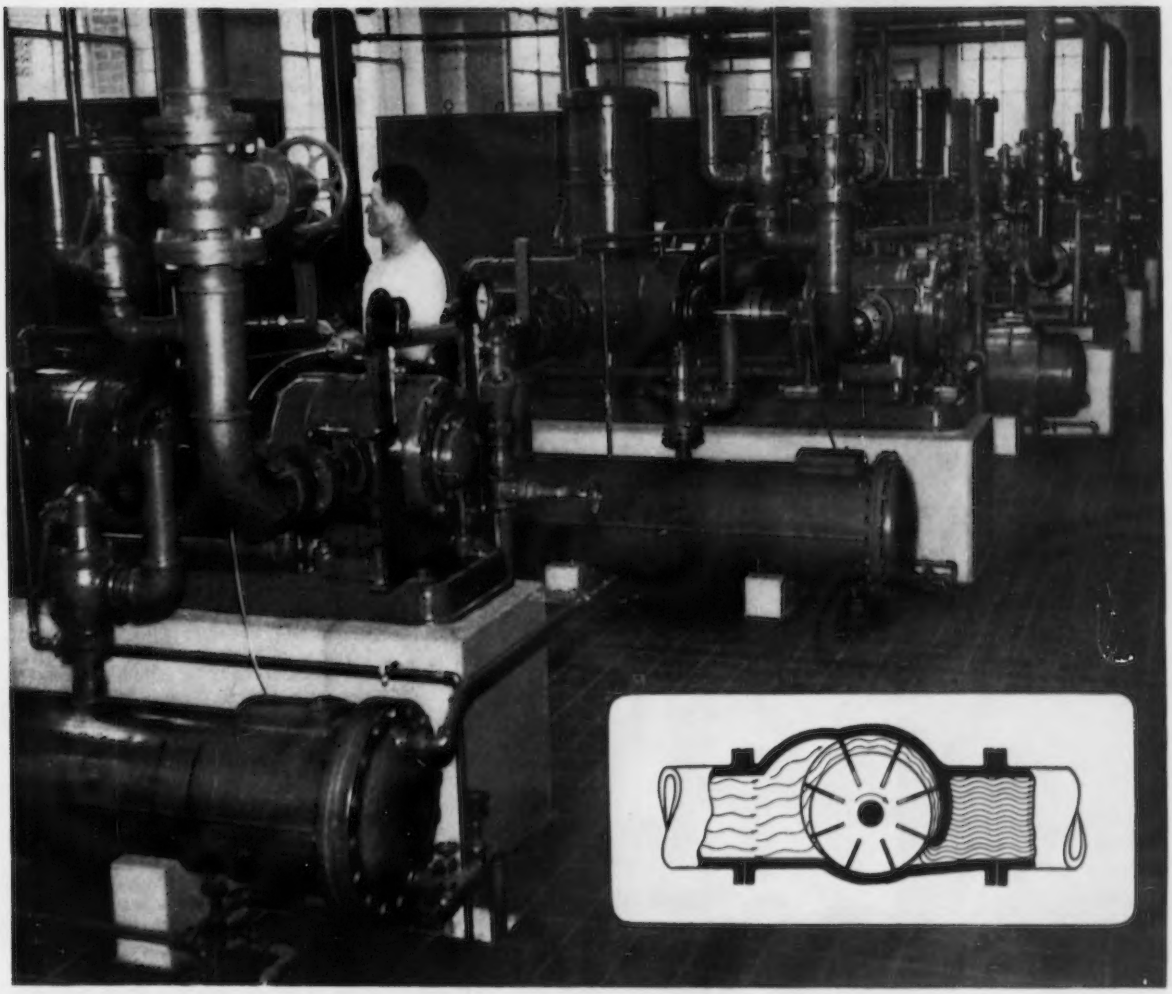

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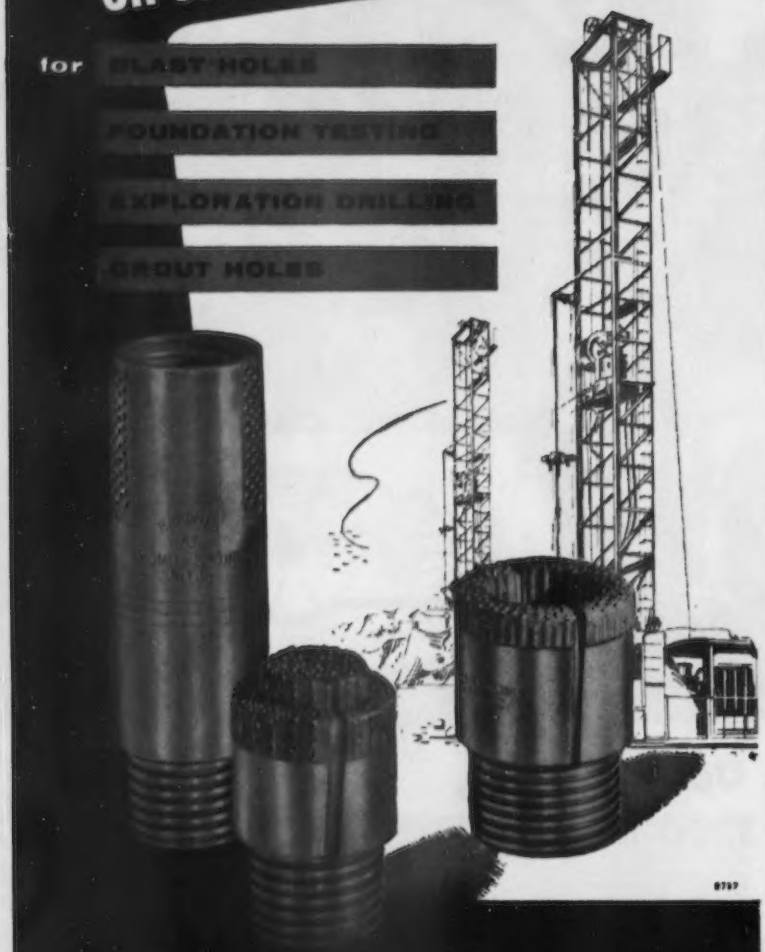

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- Dependable delivery.

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North Carolina *(Continued)*

Cowan Co. of Birmingham, Ala., has the contract for the shaft, with A. H. Bence in charge of the work.

Diamond drilling started on the Ore Knob property in January 1954. During the year 31 holes were completed for a total of 22,800 ft. Ore intersections were secured in 15, resulting in an estimate by the engineers of an indicated tonnage of 1,219,700 tons copper ore, averaging 3.09% copper, 0.9% zinc, 0.36% cobalt, 14.29% sulphur, 0.008 oz gold and 0.33 oz silver per ton.

A contract for diamond drilling in the Virgilina (Va.-N. C.) copper mining district has been let to E. J. Longyear and Co. and the work is being done under the direction of J. C. C. Blair, eastern manager of the firm, with headquarters at Max Meadows, Va.

OREGON

The state land board has approved a 5 year permit for mining of Pacific coast beach and tidewater sand and gravels under a 1955 legislative law which opens the beaches—officially state highways—to commercial mineral development. Permit would be issued to George J. Roe and Van May after conferences with the state's attorney general's office.

The terms involve issues that have no precedent in Oregon. For example, the board required that a concellation clause cover "unwarranted depredations" to protect scenic aspects of the coastline. The board's action involves a mile long stretch of the beaches in Curry County, north of the Rogue River, which drains coastal mountains once the center of an early day gold rush. The permit would grant right to extract precious metal from the ocean bed a half mile westward from high tide mark. The state would receive 10% of the sale value of the metal.

Ward chrome mining property in Grant County is being placed in shape by stripping to expose the lowest levels of early workings on a clean quarry bench from which new workings can be extended. John Day Mining Co., John Day, Ore., has milled several loads of the development ore the past spring. Mine is credited with producing up to 2500 tons of chrome ore up to 1918. The mining company also plans work at its Dry Camp property, closed for winter, when the Ward development is finished.

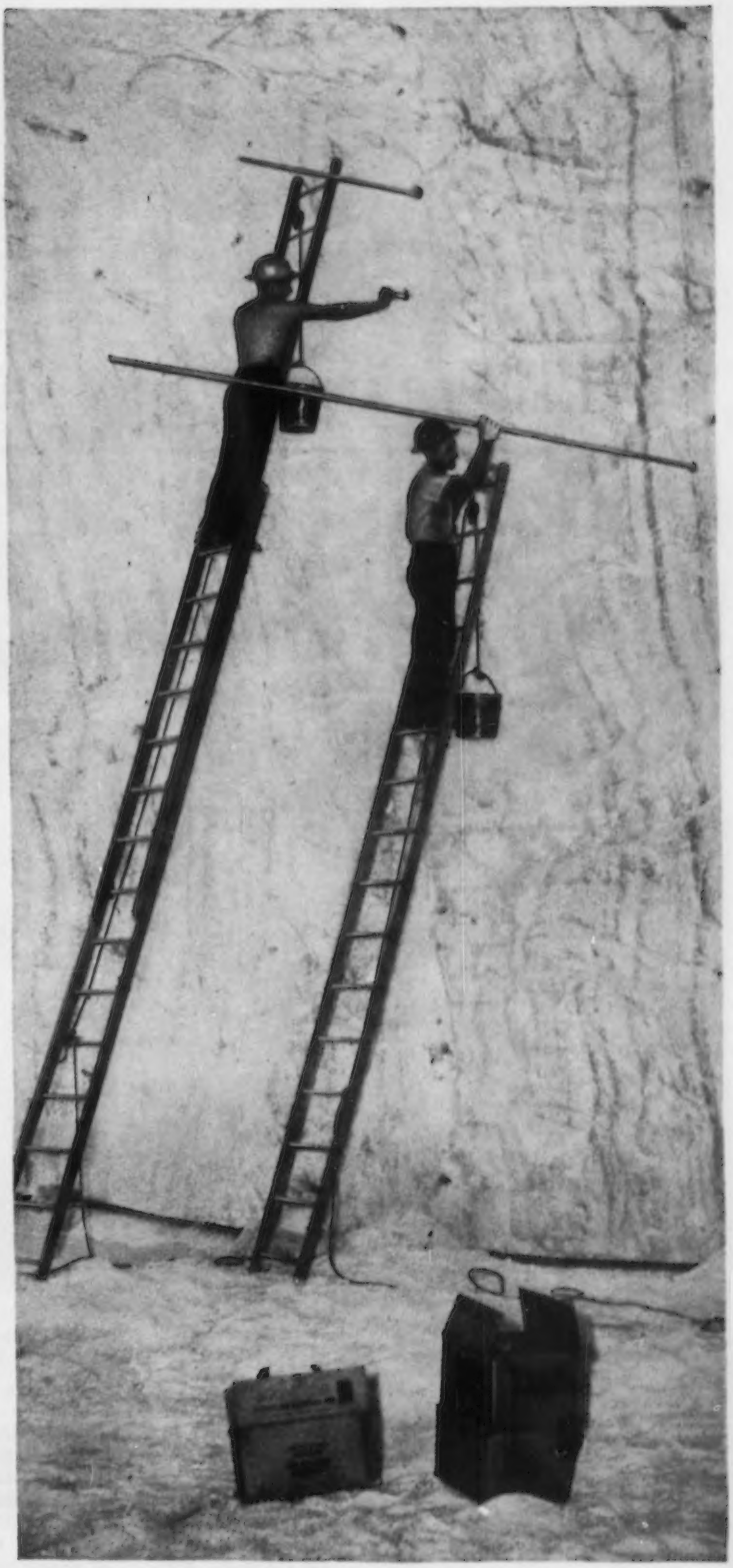
Great Lakes Carbon Corp. is test drilling extensive diatomite holdings in Otis basin district of Harney County. 30-in. diameter holes are being sunk to allow lowering of field geologist for direct observation and sampling.

TEXAS

American Smelting & Refining Co. will expand capacity at its Corpus Christi electrolytic zinc plant from 6,500 short tons per month to approximately 9,000

Mining Rock Salt 1000 Ft. Underground

WHERE EXPLOSIVES RESEARCH PAYS OFF



Using ladders, the blasting crew loads cartridges of Hercomite® into the upper rows of drill holes in a 24-ft. high working face 1,000 ft. underground in Jefferson Salt Company's mine in Louisiana.

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AN59-6

Texas *(Continued)*

tons. Plant produces Special High Grade zinc.

Zinc fume recovered at other AS&R smelting plants from lead slag will be the raw material for Corpus Christi.

UTAH

Atlas Corp.'s Hidden Splendor Mining Co. has agreed to buy the Ruddock-family controlled Almar Minerals, Inc. in a multi-million dollar deal.

The mining firm will acquire the properties, including the 51% interest in the Daniel and Ruddock claims in Big Indian District, San Juan County, through assignment of an option by Mountain Mesa Uranium Corp. (*E&MJ*, July 1955, p 158)

Under the new arrangement, Mountain Mesa will retain its option to buy all the common stock of Cal-Uranium Corp., one of the oldest producers in the district.

The following statement was authorized by Floyd B. Odlum; M. K. Ruddock, president of Almar and vice president of Cal-Uranium; Maurice Yates, Salt Lake City and H. O. English, Casper, Wyo.

The statement: "Hidden Splendor Mining Co., a 100% subsidiary of Atlas Corp. has acquired option to buy for cash all the outstanding shares of Almar Minerals, Inc.

"Almar has 51% interest in the Daniel-Ruddock orebody. It is located in the Big Indian Mining District between the Radon orebody of Federal Uranium Corp. and the Alice orebody of the Homestake Mining Co.

"In addition, Almar Minerals Inc. has approximately 700 mining claims throughout the Colorado Plateau. This option was acquired from the Ruddock interests by assignment of the option which Mountain Mesa Uranium Corp. had on the stock," the statement continued.

As the Odlum-connected Federal Uranium Corp. already owns 34% interest in the Daniel-Ruddock orebody, the Almar Minerals transaction now gives the financier and his associates 85% of the ore—value of which has been estimated as high as $50-million.

Homestake Mining Co. owns the remaining 15% interest in the Daniel-Ruddock orebody.

A 400-ft shaft is currently being sunk on the Daniel-Ruddock claims by Centennial Development Co., a Eureka, Utah, mine contracting outfit.

Hecla Mining Co., under a management contract, is now sinking a shaft on Federal's Radon claims, preparatory to mining an orebody previously delineated by drilling. This shaft is down about 160 ft.

In addition to these orebodies, Atlas Corp. controls through three subsidiaries some 66⅔% of the Lisbon Uranium Corp., which in last several months has seen development of five ore areas in drilling by Moab Drilling Co. (Charles A. Steen's firm.)

Pioneer Uranium Corp., with headquarters in Moab, and British Western America Uranium Corp., with main offices in Denver announced merger plans early in July.

Pioneer stockholders were to meet Aug. 1 to consider the proposal. President of Pioneer is Dan O'Laurie, who financed sinking of the shaft that opened up Charles Steen's Mi Vida orebody.

Atlas Uranium Corp., which has been producing ore from its Last Chance mine, San Juan County, since February, prepared in early July to take over Paramount Uranium Corp. Officials of both companies had approved the merger, and were threshing out details of the stock exchange ratio preparatory to formal agreement.

Texas Rare Minerals, Ltd., of Houston, Texas, has entered the southeastern Utah uranium field. Initial operations included 50-50 deals with the Susan B Uranium Corp. and with Atlas Uranium Corp. for drilling explorations.

Joint uranium venture which Nabob Silver-Lead Co., Merger Mines Corp. and Bismark Mining Co. are carrying out on the Dead Horse Point property along the Colorado River near Moab is developing into the biggest discovery in the Colorado River rim country, officials report. Diamond drilling has disclosed an 80-ft zone

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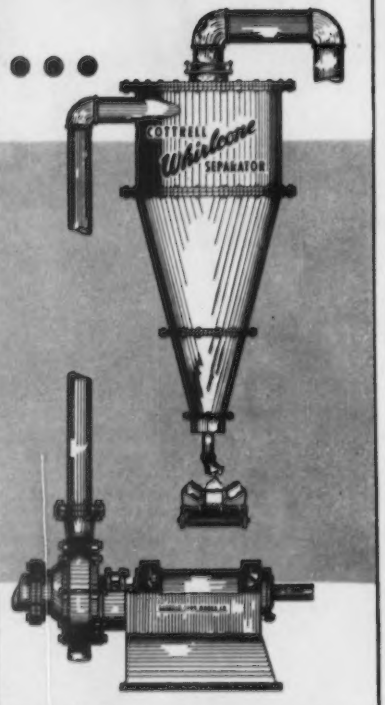
Thousands of tons of valuable sand in the minus 50 mesh range are lost with wash water in Sand Plants all over the world. The well-known Cottrell Whirlcone Separator will save this sand at small cost.



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performance of new SIMPLICITY GRIZZLY-FEEDER draws highest praise from user . . . E. W. Hallett

View showing discharge end of the Simplicity 3' x 10' Grizzly-Feeder.

A year ago Mr. E. W. Hallett, President of the Hallett Construction Company of Crosby, Minnesota ordered a Simplicity Oscillating Feeder with a grizzly deck. In a letter we received from him recently, he says: "That feeder works perfectly, and we have never had one pebble hang up on the grizzly part of it. We are very much pleased with it. I believe that it would feed 700 tons an hour if we were to call on it to do it." This is high praise indeed, but it is praise well directed, for the Simplicity Grizzly-Feeder is a new and important contribution to the mining and quarrying industry.

Cuts costs 50%

This unit combines scalping and feeding in one operation, thus completely eliminating the old type apron conveyor and stationary grizzly. The savings are readily apparent . . . you gain additional plant room and save 50% in operation and maintenance costs. The unit is available in sizes from 2' x 8' to 6' x 12', and in capacities up to 1000 tons per hour. A request to us at Durand or to any of our many sales representatives will bring you full information about the Grizzly-Feeder.

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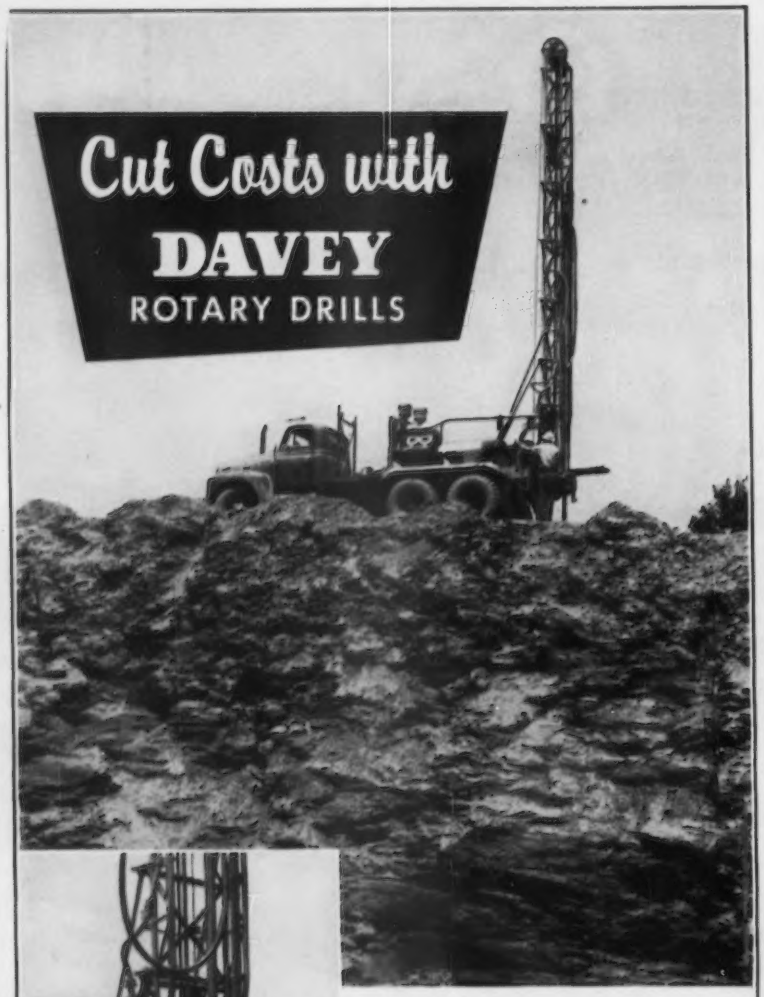

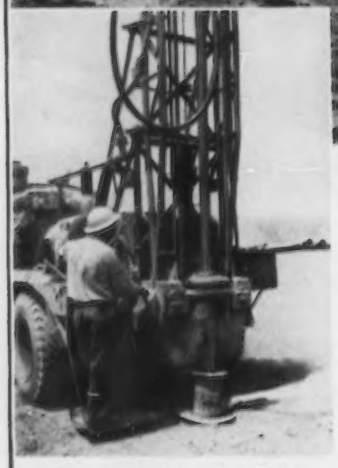

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The Davey M-8MA, as illustrated, is rated at 1,000 ft. Normal performance with a 6-inch drill bit is 150 to 600 ft. in sedimentary rock formation with air. With a 9-inch drill bit, it will drill to 1,000 ft. plus.

The combination of an air compressor and mud pump permits drilling with either air or water. Suitable for mounting on any make of truck . . . choice of power take-off or separate power unit operation. AA-1742

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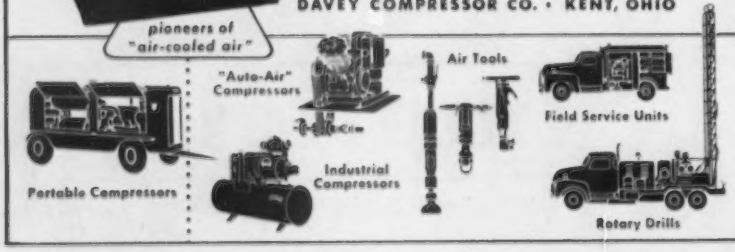

Utah *(Continued)*

of commercial ore in one area on the claims, and 400 ft farther east test holes have also encountered ore of commercial grade. Whether or not the two zones are both part of the same mineralized channel remains to be determined.

Some ore has been taken from the tunnel work and it is being stockpiled pending completion of negotiations with the Atomic Energy Commission for a preliminary purchase contract.

C. H. Hunter, president of the Merger company, is directing the exploration and development program.

Moab Uranium Co. announced in June discovery of a $300,000 orebody on its Rimrock claims in San Juan County. Claims are under lease to Walter Kassel of Kassel Uranium Enterprises, who made the strike and who holds an option to buy the property.

Merger of Cherokee-Uranium Corp. with Ventures, Inc., Grand Junction, Colo. into Beaver Mesa Uranium Co. is proposed.

Beaver Mesa will then operate six properties on Beaver Mesa District in Utah and Colorado on which a reported 249,495 tons of uranium-vanadium ore has been blocked out.

Some 1,200 tons of uranium ore have been stockpiled by Royal Uranium Co. at the firm's Indian Creek, District, San Juan County, company president George H. Patterson reports. Token shipments to determine mill valuations are being made to the Monticello mill. Firm will then seek an AEC contract for the Shinarump ore on which chemical assays have been as high as 1% uranium oxide.

Daniels Construction Co., Albuquerque, N. M., has been awarded $750,000 contract for stripping at the Continental Uranium Co.'s open pit uranium prospect in the La Sal-Paradox district, San Juan County.

Gerald Gidwitz, Continental's board chairman, reports that the Rattlesnake open pit mine will be shipping uranium ore by March 1956. It is owned by Woodmont, Inc. a wholly-owned Continental subsidiary.

Two and one-half million cubic yards of over burden with average depth of 170 ft must be removed before ore is reached.

This uranium-vanadium deposit will be one of the main resource bases for the mill proposed by Continental and Minerals Engineering Co. in the Moab area.

Bolivar Uranium Corp. has reported a significant uranium find on Amuranium's Brown's Hole property at Lisbon Valley. Production on the ore, running 0.4% uranium and 3% vanadium is expected this summer. Reserves of 8,000 tons have been blocked out.

Bolivar Uranium also has located uranium-bearing property in Coyote area, New Mexico. 800 tons, 0.3% uranium, ore are reported in sight at one claim. Several other veins have been located. Ore contains uranium, thorium, vanadium and up to 5% copper. Amuranium holds interest in both properties.

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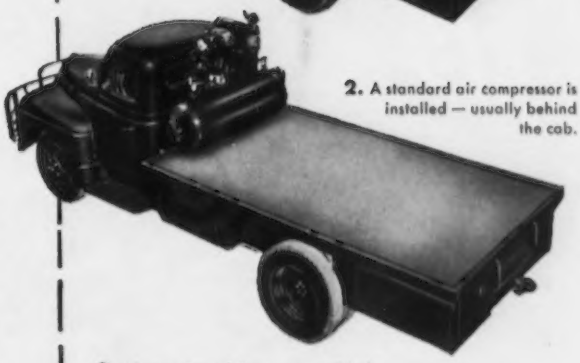
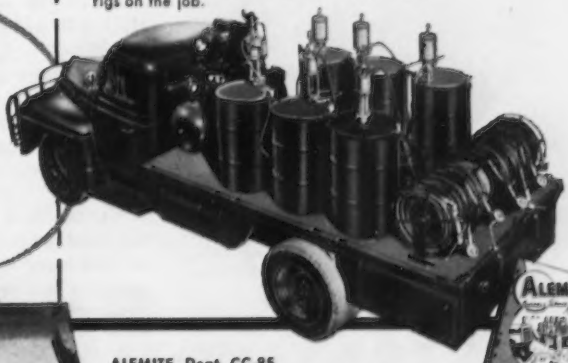


2. A standard air compressor is installed — usually behind the cab.

3. Alemite Barrel Pumps are added to handle pressure gun and gear lubricants, motor oils, you'll use.



4. A bank of Alemite hose reels are added. They reach out in a 40' working radius to service your rigs on the job.

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WASHINGTON

Tungsten Uranium Mines, Inc., Spokane, which is stripping a radioactive area at its Germania tungsten mine property in Stevens County, north of the Spokane Indian Reservation, planned to start bulldozer stripping in June on a 670 acre lease in the Dartford area where promising scintillator readings had been made, according to Wellman Clark, secretary-treasurer.

Chewelah Copper Co. has encountered ore in a 5-ft vein in Copper King tunnel of its Amazon property on Eagle Mountain, near Chewelah, which is of high enough grade for trucking directly to the Tacoma smelter; and, according to Earl Gibbs, mining contractor, a second shift has begun with the probability that a third will soon be added. Retimbering is progressing in the old United Copper tunnel at the 1,000-ft level and new track is being installed.

A survey is being made to determine the amount of ore in all veins of the different properties, Mr. Gibbs reported.

Daybreak Uranium, Inc., has received an initial shipping contract from AEC, which was to buy 500 tons of ore starting July 1. AEC, which is drilling its fourth hole at the property, according to Kae Sowers, secretary-treasurer, has been in "good rich ore" from 42 to 62½ ft. It is reported that commercial ore was cut for 25 ft in AEC's first drill hole.

Dr William F. Zelezny, metallurgist in the industrial research division at Washington State College's Institute of Technology, has two research groups working on problems connected with titanium's bearing qualities. In specially designed equipment, samples are subjected to high temperatures under nitrogen or ammonia atmospheres.

A superior court suit to gain one-third interest in the Midnite Mines, Inc., properties on the Spokane Indian reservation has been settled by a compromise agreement between contesting parties.

Leo Bruce of Spokane, a Chippewa Indian, contended in his suit for an interest in the mine that he had participated in prospecting trips with the locaters of Midnite until the day before their discovery. Mrs. Bruce is a member of the Spokane tribe, and a niece of John and James LeBret, the mine discoverers.

Under the settlement, Mrs. Bruce received 98 voting shares in the development, voluntarily surrendered by Midnite directors.

A uranium "rush" was begun in June in the Bumping Lake region of Yakima County about 50 miles west of Yakima. Eighty claims had been filed by June 20, all within a short distance of the six claims which had already been filed on by Tom Hendrix, who was the original locator of what he believes may be a rich find.

WISCONSIN

American Zinc, Lead & Smelting Co, will expand its production by some 18,000 to 25,000 tons of combined zinc-lead concentrates per year with the acquisition of "substantial" mining and milling properties in Wisconsin, the firm has announced.

American Zinc has already acquired leases on 370 acres from Cuba City Mining Co., Cuba City, and will begin development shortly. Mine will be in production by mid-1956 and will produce an estimated 12,000 tons of zinc concentrates per year.

In another transaction, American Zinc has arranged to acquire milling facilities and mining leases and equipment of Vinegar Hill Zinc Co., a subsidiary of Youngstown Sheet and Tube Co. Tonnages from the combined leases will supply the mill for six to eight years, company spokesmen said. Mill has a rated capacity of 800 tpd.

WYOMING

New Park Mining Co. and Lucky Mc Uranium Co. have employed Battelle Memorial Institute to develop a flowsheet

Over a quarter century ago the first (and original) double-trunnion dump car was placed in service by Differential on the L & N. Sound engineering and careful workmanship were such that this car is still in service — still earning money for its owners.

Such details as hardened, self-lubricating pins in door mechanisms, rolled steel weldments instead of castings (making repairs easier when repairs are necessary)—these are examples of details that put Differential in the lead more than 25 years ago — and keep it there!

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New Plant now in production taps natural source of sodium sulfate

West End Chemical Company now is producing Salt Cake and Anhydrous Sodium Sulfate at the rate of approximately 50,000 tons annually. These new products maintain the *premium quality* which has characterized West End Soda Ash and Borax for over 30 years. We proudly add Salt Cake and Anhydrous Sodium Sulfate to the list of industrial chemicals carrying the well-known West End brand.

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Wyoming *(Continued)*

for beneficiation of ores in the Gas Hills district, Freemont County.

Robert Porter, Salt Lake City, consulting metallurgist, is advising on the program.

Meanwhile, Robert L. Cranmer, secretary of the firms, said the Atomic Energy Commission at Grand Junction had been notified formally that Lucky Mc desired to erect a 1,000-ton concentrator at Riverton.

Six drilling rigs are now at work on Lucky Mc Property delineating reserves. Aim is to develop sufficient proved ore to support a concentrator of the size outlined.

"To date, we have sufficient ore in opinion of engineers for a 500-tpd mill."

Intermountain Chemical Co. has called for bids on construction of a $1¼-million mine shaft at the firm's Westvaco trona mine near Green River, operated by the Westvaco Chlor-Alkali Division of Food Machinery and Chemical Corp.

C. A. Romano, resident manager, said that No. 3 shaft would be concrete lined, 18 ft in diameter.

New shaft will improve mine ventilation and increase ore recovery efficiency. Through the pillar recovery allowed by the new shaft, percentage recovery of ore should be nearly doubled without greatly affecting the production rate. The new system will carry 300,000 cu ft of fresh air into the mine.

Vitro Minerals Corp., joint affiliate of Rochester and Pittsburgh Coal Co. and Vitro Corporation of America, has scheduled production of 1,500 tons monthly from its Sateco lease, Gas Hills District, Fremont County.

Jack O. Horton, Vitro Minerals general manager, said output in June was between 1,200 and 1,300 tons.

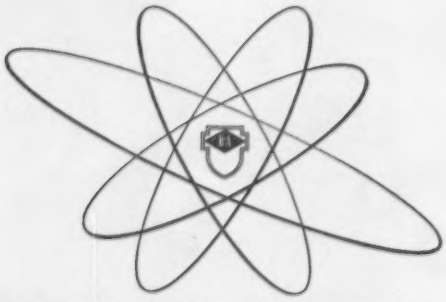
Breakdown of dragline operations kept the firm from reaching the 1,500 goal in June, he said.

Through blending at the open pit mine, ore sent to the Vitro Uranium Corp.'s Salt Lake mill has been kept between .23% and .25% uranium oxide.

First load of uranium ore from the Dry Lakes area 9 miles from Casper has been delivered to the Atomic Energy Commission's buying station in Riverton.

Firm indicated shipments will be made regularly if results of the trial shipment are satisfactory.

First loads of ore also were received from Joe Wentz and Silas P. Silverman, who own claims in the Cyclone Ridge area south of Waltman in the Gas Hills, Fremont County.



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IN CANADA

BRITISH COLUMBIA

A uranium prospect on the banks of the Thompson River near Lytton, is being developed by the newly-formed Rose Mining Co. Ltd. of Vancouver. Exploratory adit will be driven on the 48-claim property two miles northeast of Lytton, just above highwater on the Thompson. F. H. Hemsworth, general manager and consulting engineer for the company, reports high counts on a scintillometer on three widely separated outcrops. Radioactivity is pronounced adjacent to a contact between quartz diorite of the Mount Lytton batholith and an altered oxidized sedimentary rock.

Consolidated Mining and Smelting Company of Canada Ltd., and International Union of Mine, Mill and Smelter Workers at Trail and Kimberley smelters have reached a settlement providing 5¢-an-hour wage boost across the board.

Bethlehem Copper Corporation Ltd., new British Columbia company, has acquired 100 claims covering 5,000 acres 25 miles south of Ashcroft in the center of the province. Rich copper indications during $25,000 bulldozer stripping program, have spurred company's exploration program, and officials are already speaking in terms of a 10,000 tpd mill, and reports of deals with major companies are persistent.

Directors include John A. McLallen, chairman of board; H. H. Huestis, president; John D. Rochfort, vice-president;

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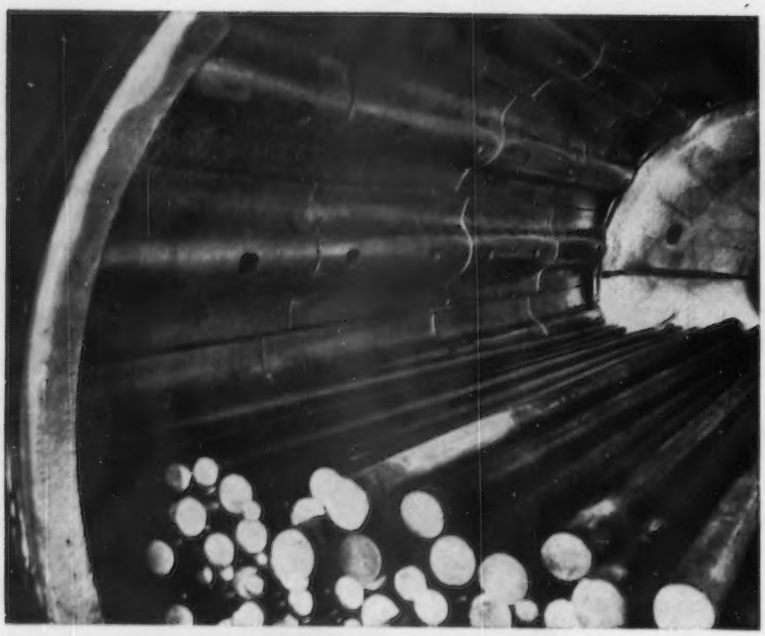

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British Columbia *(Continued)*

Hugh Martin and Donald F. Farris, all of Vancouver. James L. Lawrence of Vancouver is secretary and solicitor, and Reynolds, Milne and Company is auditor. Farris also is president and managing director of Beaver Lodge Uraniums. Dr. W. H. White, associate professor of geology at University of British Columbia, is directing technical work this summer.

Prospecting by present operators oriented two new zones of mineralization over considerable widths. In one zone, grab samples from outcrops occurring over a minimum width of 400 ft have returned assays of 3.75% copper, with gold and silver estimated at appreciable values.

ONTARIO

Blind River now appears to be sure of having a fourth producer (following Pronto and the two mines being established by Algom Uranium Mines). Consolidated Denison Mines is now able to report 12.4-million tons averaging 0.125 U_3O_8. Tonnage, calculated for the main drilled area adjoining Algom's Quirke Lake ground, has an excellent chance of being increased to 30-million tons when the company's property has been thoroughly explored. It is expected that the mill will have a capacity of 4-5,000 tons daily.

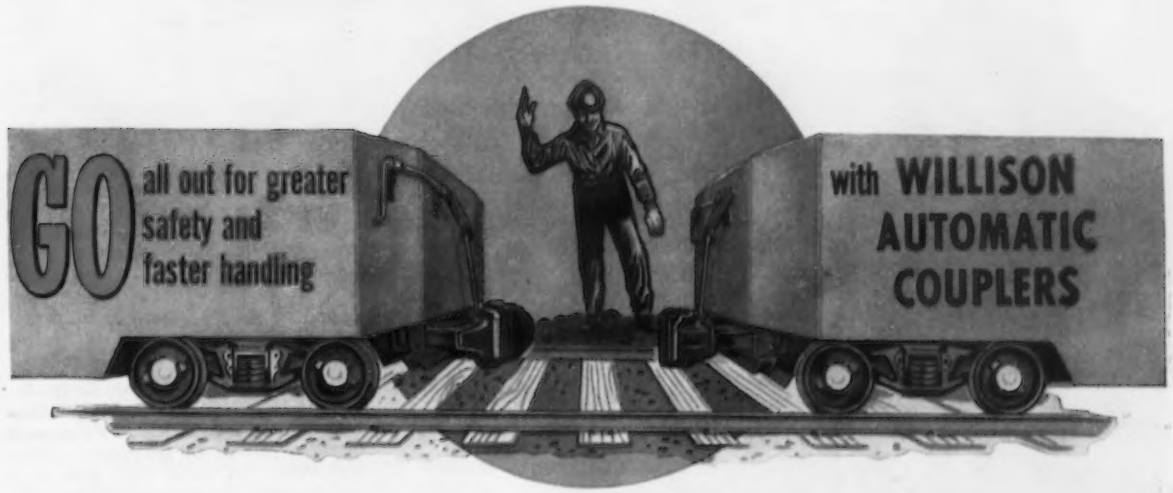
Jardun Mines has finished the sinking of its No. 5 shaft at its Victoria lead-zinc mine northwest of Sault Ste. Marie. New opening is to become the main production channel for the mine, and will permit mill production up to 300 tpd.

American Nepheline Ltd., Canada's sole nepheline syenite producer, with mine at mill at Nephton, Eastern Ontario, has started a $2.5-million expansion program to raise capacity by 500 tpd.

Start of mill construction at its new Fecunis mine on the northwest rim of the Sudbury basin will be made this fall by Falconbridge Nickel Mines. Rated capacity may be 2,000 tpd. Two shafts are already being sunk; main five-compartment production shaft being headed for 4400 ft, while the smaller service shaft has 3300 ft as its objective. Fecunis orebody, discovered in deep surface drilling three years ago, has an indicated volume of 10-million tons of typical Sudbury nickel-copper ore, and new mine will be Falconbridge's largest single operation.

Biggest production year in history is anticipated for 1955 by Ontario's two iron ore producers. Algoma Ore Properties, subsidiary of Algoma Steel Corp., expects to produce and sell 1,450,000 tons of sinter, compared with 1-million tons in 1954. Steep Rock Iron Mines, still in the expansion stage at its property near Atikokan, has enough orders on hand to send this year's output over all previous marks to reach 1,750,000 tons.

Number of companies are engaged in exploration in the new McKirdy lithium



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Ontario (*Continued*)

area, northwest of Port Arthur, with Nama Creek Mines the first to start diamond drilling. Others active in the area include Conwest Exploration Co., Nudulama Mines. MacLeod-Cockshutt Gold Mines, Charles Long Lac Gold Mines, Novell Porcupine Gold Mines, Wesley Mines, and Dunvegan Mines.

Plans are being made for a three-compartment shaft by Coppercorp Ltd., new company formed on an old copper prospect in the Mamainse district on the east shore of Lake Superior, 60 miles north of Sault Ste. Marie. Initial objective is 500 ft, with three levels to be opened. Knowledge of the showing goes back to 1672, when native copper was mined by the Indians; but little work was done until a few years ago. Extensive drilling over the past couple of years has indicated 600,000 tons to a depth of 250 ft, averaging 2.75% copper, or 1-million tons with grade of 1.75%. A milling operation of 250-500 tpd is visualized.

Manitouwadge area seems slated to have a second copper-zinc producer (Geco Mines will be the first), following calculation of indicated reserves by Willroy Mines. Two main zones have been outlined: No. 3 zone with 719,000 tons averaging 1.27% copper, 10.4% zinc, and 1.5 oz silver per ton to depth of 700 ft; and No. 1 zone, with 796,000 tons averaging 1.5% copper, 0.46% zinc, and 0.47 oz silver to depth of 500 ft. No. 2 zone, in which numerous zinc-silver sections were encountered in drilling, is considered too irregular for tonnage calculations yet. Company is making underground plans, and will sink a four-compartment shaft as soon as power is available in the fall.

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QUEBEC

Mill at the property of Campbell Chibougamau Mines, new copper producer of the Chibougamau area, has geen giving a fine account of itself. First ore was treated in May, and by mid-June the plant was up to rated capacity of 1,750 tpd. Recovery is reported entirely satisfactory, and management is confident that production objectives will be met without difficulty. The company has a contract calling for delivery of upwards of 63-million lb of copper to GSA in Washington. Concentrates are trucked by road 150 miles to the railway at St. Felicien, whence they are shipped to the Noranda smelter; but by next year completion of the branch railroad now going into Chibougamau will permit shipments to be made direct by rail.

One of the busiest sections in Quebec this summer is the Gerido Lake area, just south of Ungava Bay in the extreme northern part of the province. A potential copper field is in sight there, with big tonnages of low grade in evidence.

The area is remote, without power, transportation, or population, but early operators are optimistic. First in the area was Holannah Mines, joint subsidiary of Hollinger Consolidated Gold Mines and the Hanna interests of Cleveland, but more than a score of other companies have since acquired ground. Possible size of the area may be gaged from the fact that copper sulphide deposits have been noted at many points along a 50-mile belt, while the extreme length of the structure could be 150 miles.

Excellent results are reported by Normetal Mining Corp. from the development work done so far on the deepest of its five new levels. Drifting on the 5165-ft horizon shows 830 ft length averaging 3.4% copper and 5.6% zinc across average width of 10 ft. Results suggest that 1,000 ft of depth has been added to the mine.

Louvicourt Goldfield Corp. and Standard Gold Mines are sharing 50-50 in a gold-base metals exploration project in Beauce Co., southwest of Quebec City. Area was the site of gold placer mining many years ago, and good indications of copper have been had; but uncertainty of minerals rights ownership has kept the district inactive for a long time. Two companies have obtained prospecting rights on a 53,000-acre tract.

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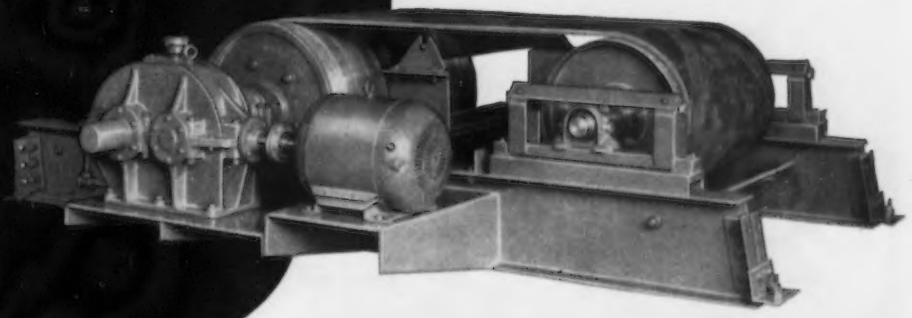

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Quebec *(Continued)*

A large scale exploration project is under way in the area north on the Canadian National Railway's transcontinental line just east of the Ontario boundary, where Mining Corporation of Canada and International Nickel Co. have been combining forces in an airborne electromagnetic survey. Survey covers large parts of the townships of Chazel, Claremont, Desmeloizes, and Perron, and large areas of ground have already been staked or otherwise acquired in places where the survey gave encouragement. Five drilling firms are operating.

Dominion Asbestos Mines, whose asbestos mining operation in the Eastern Townships proved abortive, has acquired a columbium prospect in the Oka district, 40 miles west of Montreal.

SASKATCHEWAN

Vigorous development program has been recommended at its Pitcho group of mineral claims near Uranium City by Independence Mining Co. Ltd. following deposition of high-grade uranium. Discovery was made as result of recent stripping on north shore of Bearskin Lake, according to report of Edward G. Brown, president.

Consulting geological engineer Alfred R. Allen, reports the zone is exposed for 30 ft and is almost vertical in dip, lying along an irregular contact between a band of mafic rock and crushed granite. A full crew is at work under supervision of Murray Swetz of Vancouver.

Joint drilling program of Beaver Lodge Uranium Mines Ltd. with Baska Uranium Mines Limited in northern Saskatchewan is progressing favorably, according to announcement by Donald F. Farris of Vancouver, Beaver Lodge president W. W. Archer, who was in charge of drilling this spring, says drilling to date indicates sufficient ore to justify going underground. He recommends that a production shaft be started as soon as possible after the current drilling program is completed.

James Mackee, chairman of board of Beaver Lodge, said the company has several crews staking claims in the area 15 miles southeast of Ashcroft and expected to have 130 claims staked by end of June.

NORTHWEST TERRITORIES

Steady post-war increase in value of minerals produced in Northwest Territories and the Yukon continued throughout last year, a report prepared by Canadian Department of Northern Affairs and National Resources indicates.

In a complete statistical picture of mining progress in the Canadian north, the government's report showed that in Northwest Territories, gold, silver, petroleum and natural gas produced was valued at $10,588,781, while in Yukon value of mineral production amounted to $16,308,108, an increase of 15% over the preceding year.

Even more striking had been rate of growth in Yukon's mining industry in five-year period 1949-54 when value of minerals produced more than tripled.

In Northwest Territories, gold was again most important mineral. Three mines in Yellowknife District set new production records in turning out 299,182 oz of gold worth $10,193,131. Silver production was valued at $47,880.

Consolidated Discovery Yellowknife Mines Ltd. milled about 105 tpd gold ore with average gold production per month throughout the year at 4,697 oz.

At the Con mine of Consolidated Mining and Smelting Co. of Canada, about 460 tpd ore was milled, with average production about 6,965 oz gold per month and about 2,058 oz silver.

Giant Yellowknife Gold Mines Ltd. milled about 700 tpd ore for production averages of 13,500 oz gold and 2,500 oz silver per month.

At Eldorado Mining and Refining Ltd. mine at Port Radium production remained normal, but security reasons precluded publication of statistics.

Uranium and base metals continued to highlight staking activities in Northwest Territories.

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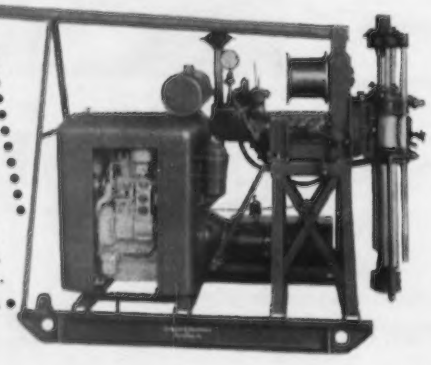

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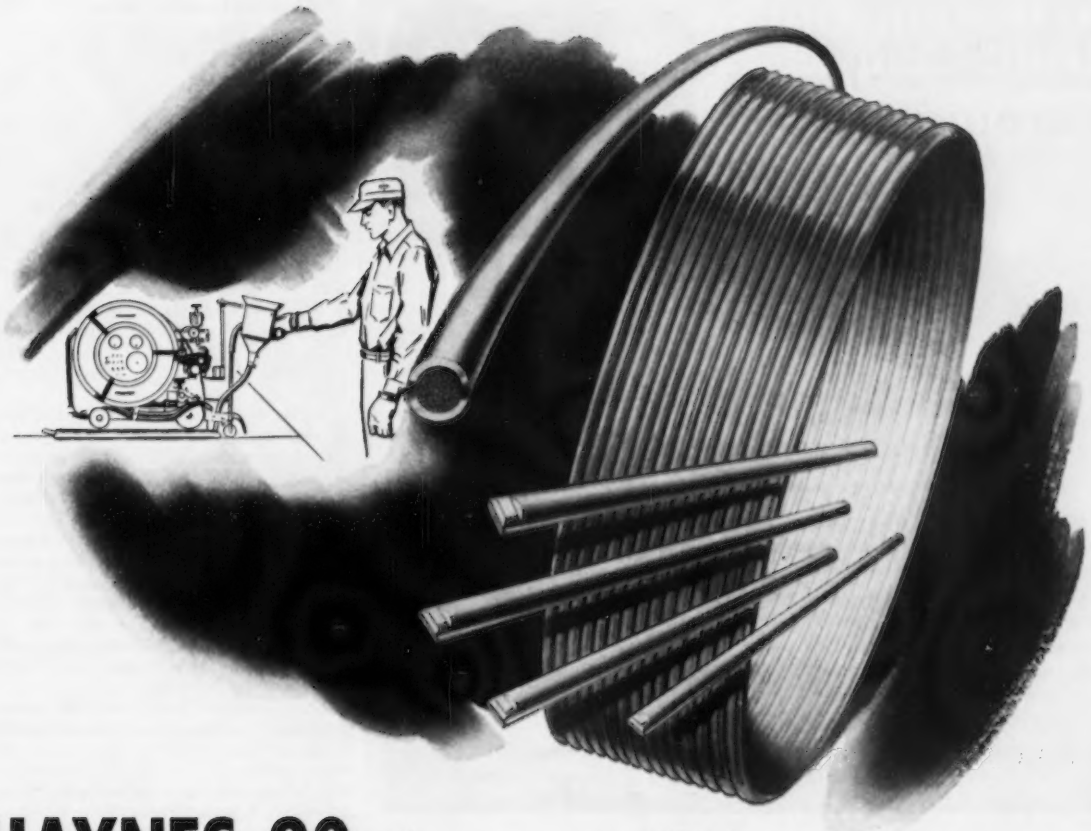

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HAYNES 93, HASCROME, and HAYSTELLITE alloys are also available in this economical tube rod form. HAYNES 93 iron-base rod is noted for high abrasion and corrosion resistance . . . HASCROME iron-base rod for high impact resistance . . . and HAYSTELLITE tungsten carbide rod is tops for resistance to severe abrasion.

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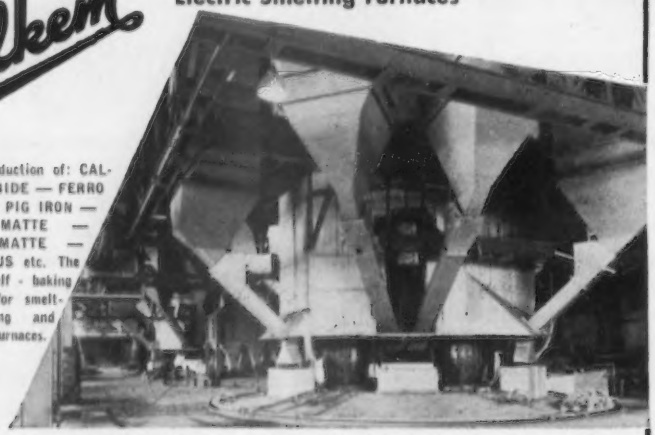

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NW Territories *(Continued)*

Copper discoveries were made in Tree River area on Arctic coast. Giant Yellowknife Gold Mines exploration subsidiary staked uranium showing near Thekalthili Lake which sparked a staking rush to the area. Considerable activity was centered around Marian River area, where good diamond drill intersections were made.

Late in the year a staking rush developed in the Marian Lake area when prospectors working in that area discovered good grade pitchblende on claims they had staked earlier in the season.

Values of minerals produced in Yukon in 1954 were as follows: gold—$2,991,721; silver—$5,627,435; lead—$4,340,000; zinc—$2,757,725; and cadmium—$366,223.

In Dawson mining district, placer gold producing region of the Yukon, a shortage of water supply was felt through the season. In Klondike area, Yukon Consolidated Gold Corp. operated six dredges and one hydraulic operation on Bonanza, Dominion, Hunker and Sulphur Creeks between May 1 and Dec. 1 with cubic yardage dredged amounting to 5,115,815 from which gold valued at $1,742,320 was produced.

At the end of 1954, there were 160 quartz mining claims in good standing in Dawson mining district.

These covered silver-lead-zinc prospects in Dawson area, silver-lead-tungsten claims on Casino Creek, a group of asbestos claims at Thomas Gulch, fluorite and bornite ore finds on Sixtymile River and Gold Bottom Creek.

This summer, a number of U.S. and Canadian mining companies will carry on extensive activity in the area in and around the Northwest Territories. For a discussion of some of the new activity, see page 72.

IN LATIN AMERICA

ARGENTINA

Argentina is reportedly actively pushing output of uranium ore towards stockpiling. Country now has five uranium mines considered of major importance. Two are located in the province of Mendoza, one in Malargüe and another in Potrerillos. A third is near Sañogasta and the fourth in Paganzo, both in La Rioja providence.

The fifth mine is situated in Guanchin, La Rioja. It is a seven vein deposit of high grade ore, and to enable it to deliver monthly shipments of 30 to 35 tons, mining facilities are now being rushed to completion.

In June, construction of a 5 km road leading from Guanchin to the mine proper was completed. Known as "Don Michel", the mine is owned and operated by Michel Waidatt of Chilecito, La Rioja, whose output will be bought by the government, which has granted him official support to undertake the present improvements and installations.

Production of calcium oxide and calcium carbonate is on the upgrade and it is now anticipated that domestic requirements, formerly imported, will soon be satisfied entirely from local output. Canteras Caleras Industrias Quimicas Asociados "El Refugio" in the Jachal area of San Juan province recently concluded overhauling its equipment and general mining installations and now is able to cope with a daily output of 35 tons of calcium oxide and 15 tons of calcium carbonate. Driven with diesel powered units, it has its own electric power facilities, and 13,000 volts are served over a seven kilometers high tension line. The "El Refugio" establishment is built on unlimited reserves, since the entire mountain cordons of that particular area are mainly limestone.

Argentina's military plants, "Fabricaciones Militares" last month announced its present and future requirements of manganese ore and invited producers to boost their current output greatly. With present potential demand being slightly over 2-million tons of general metal products, Argentina's metallurgical industry has greatly expanded over the past five years, and the need for manganese ore is becoming increasingly tighter.

Fabricaciones Militares, which operates the pig iron plant of Zapla, Jujuy, officially stated that plans are under way to raise 30%-manganese production in accordance with the following schedule: 1955 and 1956 period, minimum output of the country should reach 5,000 metric tons; 1957 and 1958, it must soar to 7,200 tons and by 1959 total at least 10,000 tons.

During May, IAPI, the official import-export body, which exclusively markets certain Argentine ores and minerals, has concluded the following operations with private mining operators: Purchased 170 metric tons of beryllium; 7 tons of wolframite; 100 tons of lead ore and 10 tons of mica. Exports were: 400 metric tons of beryllium, all of which went to the USA and was valued at $200,000, fob. It also shipped 250 tons of wolframite to the General Service Administration; sold 24.5 tons of mica to U.S. buyers and 5 tons more to Western Germany and Italy, for a total value of $32,000. IAPI still has a rather substantial stock of mica on hand which it is anxious to sell on foreign markets.

CHILE

An agreement was signed in Santiago in 1953 between Frobisher Ltd. and Mauricio Hochschild Ltd., to investigate the copper deposits of "Mantos Blancos," situated in the north of Chile, 30 miles from the port of Antofagasta. Diamond drilling program, churn drilling and underground work, in progress the last two years, has proved a large tonnage of oxide copper ore, and there is still plenty of promising ground to be explored. Pilot plant for the study of metallurgical treatment is now under construction.

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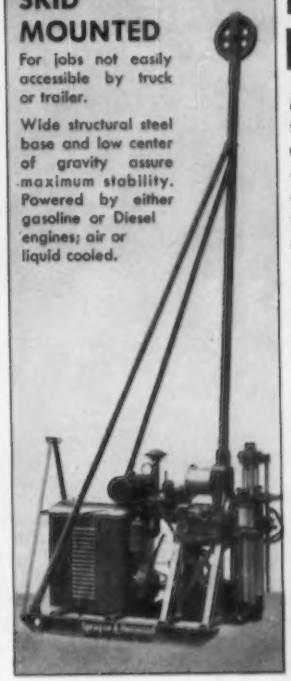

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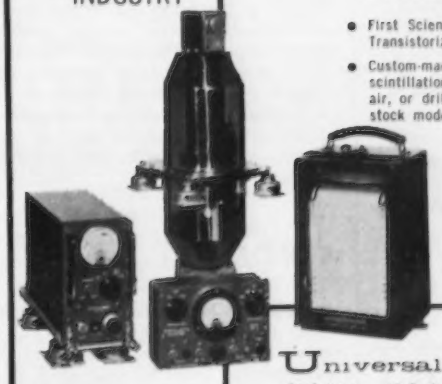

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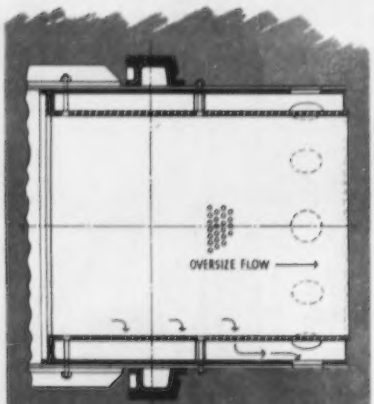

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LARGEST SINGLE ROTARY KILN for mercury processing will be built at Rare Metals Corp. of America cinnabar mine 15 miles east of Weiser, Idaho. Eimco clears rock for primary crusher site for 200-ton mill. Open pit operation, to mine ore beds 20 ft deep, is scheduled for this month.

CHILE *(Continued)*

Great Britain, Western Germany, Holland, Denmark, and Switzerland. Recently 7,149 tons copper were shipped to Europe and 4,800 tons to New York. The first shipment of copper concentrates from the new Mining Credit Bank mill at Illapel, Coquimbo province, embarked at the Los Vilos for Norddeutscher Affinerie, Hamburg, Germany.

Cerro Imán, near the town of Copiapó, Atacama province, has been shipping high grade iron ore to the U.S. Cerro Imán is a subsidiary of Compañía Salitera de Tarapacá and Antofagasta. Cerro Imán is a small, high grade iron deposit containing between 1- and 2-million tons of good grade hematite and magnetite.

Chile's production of copper this year may reach an estimated 420,000 metric tons.

Because of the good price of copper and the very satisfactory schedules being paid to small miners, small copper mining is doing very well in Chile at the present time. Many new small mills using small crushers, Chilean mills and flotation machines locally built are being put up anywhere there are sulphide copper dumps, fillings, or fair grade ore. Where the ores are oxidized, as in the northern provinces of Antofagasta, Atacama and Coquimbo, small percolation plants are being built. Corporacion de Fomento, Chilean RFC, is building a 35 metric tpd contact sulphuric acid plant at the port of Antofagasta to supply these small percolating plants.

COLOMBIA

According to Ministerio de Minas y Petroleos, Colombia's mining industry has shown another increase in output in 1954 as compared with the year 1953. Total value of the output amounted to 182.3-million pesos (US$ 72.9-million) as compared with 144.8-million pesos (US $57.9-million) in 1953.

The following are, by order of importance, the minerals mined in the two years, all figures in pesos:

	1954	1953
Gold	33,028,397	38,263,496
Platinum	4,472,169	4,615,562
Sulphur	1,248,000	...
Limestone	922,000	327,468
Barytes	720,000	989,118

Present list does not include iron ore, mining of which started in appreciable quantities for the steel works of Paz del Rio in 1954.

PERU

Consolidated Guayana Mines, Ltd., an associate company of Ventures, Ltd., in 1953, acquired, in conjunction with Frobisher Ltd., which is another subsidiary of Ventures Ltd., all the shares of Chavin Mines Corp. To reach the Santa Beatriz (Chavin) mine which is at an altitude of 4,000 m above sea level, near the borders of the provinces of Castrovirreyna and Chincha, the company built a new stretch of road, 85 km long, which joins it with 140 km of existing road to the town of Huancayo.

Mine contains lead and zinc ore with certain amounts of silver and copper. Intensive exploration work has been carried out, four levels totaling 7 km having been driven as well as raises and winzes. Reserves to date are estimated at around 250,000 metric tons, plus 100,000 tons possible.

Photographic Survey Corporation, Toronto, a member of the Hunting Group, which has been in Peru for the past two months, carried out some 8,800 sq km of vertical aerial photographic survey work for the Southern Peru Copper Corp. and Cerro de Pasco Corp.

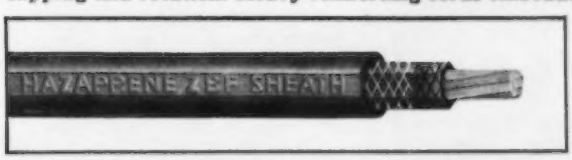
Four field parties, under the direction of Robert A. Brocklebank, are now doing

how to train a locomotive

A mine locomotive presents a pretty sorry picture to maintenance engineers when it's "dead in its tracks." No wind, no stamina, no punch—a locomotive is really out of trim without its regular diet of electricity.

That's why smart maintenance men equip their mine locomotives with Hazacord reel cables—they *really* keep mine equipment on the move.

Hazacord Locomotive Reel Cables are distinguished by Hazard's new Hex-Tite design. Hexagonal insulation, tough, heat- and moisture-resisting, provides six plane surfaces to lock with the Hazaprene ZBF sheath, preventing internal slipping and rotation. Heavy reinforcing cords embedded in both insulation



and sheath form an additional guard against pulling, and a special adhesive completes the bonded construction. Hazacord's "locked-tight" cable design is your best assurance of steady trouble-free locomotive operation.

"Compensated stranding" of conductors gives a high degree of non-fatiguing flexibility and prevents dangerous bird-caging. The Hazaprene ZBF sheath, cured under pressure in a continuous metal mold, is extremely rugged and resistant to the deteriorating effects of oil, acids, alkalies and mine water. Service records show the unusual ability of Hazaprene-sheathed Hazacord cables to withstand constant tension, rough handling, twisting and abrasion as well as heavy impact.

Write for Hazard's new Mining Cable Catalog, Bulletin H-450, for information on Hazacords for mine locomotives and other mining machinery. Hazard Insulated Wire Works, Division of The Okonite Company, Passaic, N. J.

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Peru *(Continued)*

the ground control work on the Southern Peru (Toquepala) area.

Survey for the Cerro de Pasco Corporation is to locate a possible road through this region connecting with Cerro de Pasco railways.

MEXICO

American Smelting & Refining Co. has opened to mining development an isolated area of the State of Sinaloa on Mexico's west coast. Plant cost $3-million. In Sierra Madre Occidental, 7 miles east of the town of Cosala, AS&R is now operating its Nuestra Señora Unit, a lead-zinc property.

Asarco initiated an exploration program at the Nuestra Señora Mine in 1948. While proven ore reserves are limited, Asarco decided that sufficient reserves existed to justify the building and operation of a mine and mill. Construction got underway in 1952 for a surface plant, including a 450-ton flotation mill, a diesel power plant, shops and offices. Development of the mine included sinking a 940-ft, 4-compartment vertical shaft. Shaft is bolstered with steel shaft sets, except where loose ground is encountered; here the shaft is lined with timber.

To reach the 6th level shaft station, a 1450-ft crosscut had to be driven. This effort, passing below the Elota River, encountered two water-bearing faults. A serious water problem developed which was overcome finally by grouting.

Operations were started on a reduced scale in September 1954 and continue today on a one-shift basis. Concentrates will be shipped to AS&R smelters in Mexico.

At Nuestra Señora, L. J. Slessinger is general superintendent; Arthur J. Maese, mine superintendent, and Roger Stern, mill superintendent. There are some 325 employees, including 25 office workers.

One major expansion program is underway in the Naica district of Chihuahua and another reportedly is planned for the near future.

Fresnillo Co. is carrying out a $4-million program which will include deepening of their main shaft plus installation of deep well pumps and other measures to combat ground water. Proj-

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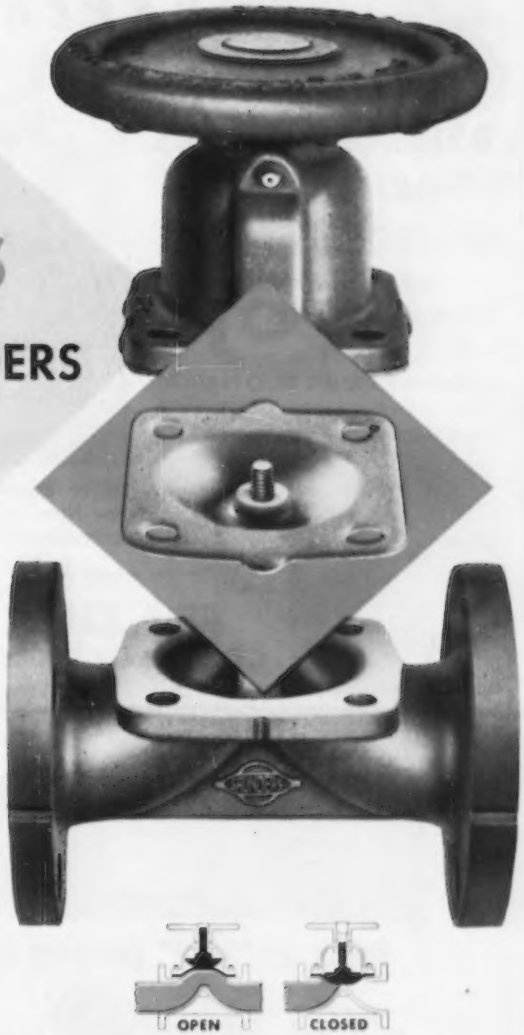

Having valve trouble? Are your chemical services so tough that valves disintegrate? Grinnell-Saunders Diaphragm Valves with TEFLON* diaphragms may solve your problems.

Grinnell TEFLON diaphragms are made by a new and unique process which produces a better product of greater density, toughness and flex life. TEFLON offers a high degree of chemical inertness to all chemicals normally found in industry.

Grinnell-Saunders Diaphragm Valves are available with bodies of iron, bronze, stainless steel, cast steel, aluminum, Monel, Saran, Durimet; and with body linings of glass, lead, soft or hard rubber, neoprene, Saran. Diaphragm life depends on temperature, pressure, and frequency of operation. Your inquiries, which should be accompanied by complete service data, will receive prompt attention.

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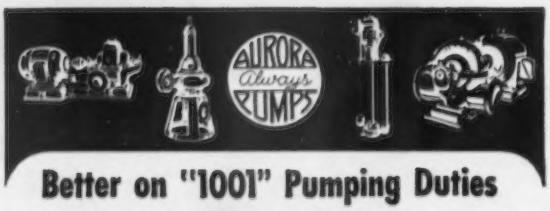

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Mexico *(Continued)*

ect is not expected to be completed until 1957.

Currently at Naica, 75 miles south of Chihuahua City, Fresnillo is milling about 600 tpd of ore. Lead concentrate is sent to American Smelting and Refining Co.'s Chihuahua smelter. Zinc concentrate is sent to the U.S. for smelting by the American Zinc Co. of Illinois, Inc.

Fresnillo's main shaft now reaches a depth of 190 meters (617.5 ft). The program now underway will lower the shaft another 150 m (487.5 ft). In addition there will be a 45-m sump (146 ft). Several deep-well pumps reportedly will be installed at about the 297-m (964 ft) level.

Shaft sinking is in charge of E. J. Longyear Co., Minneapolis.

Meanwhile, Minas de Durango Co., affiliated with Eagle Picher Co. plans erection of a 300-tpd flotation mill. Heretofore the Eagle Picher unit has been mining on only a small scale. However, a major diamond drilling exploration program has indicated that all reserves justify expanded mining activities and construction of the mill. Expansion program will cost an estimated 2-million pesos ($160,000). No definite date has been announced for the start of mill construction.

The Fresnillo and Eagle Picher units are working neighboring concessions at Naica. Both deposits contain sulphide ores, a mixture of galena, sphalerite, and pyrite—plus additional substantial values in silver.

Santa Fe Mines, in the Pichucalco district of Chiapas, is shipping now that rains are falling. An extended dry season hindered operations.

The mine is being worked through open pits and two main shafts. The deposit, mainly copper with silver values, is mineralized dome, lentcular in formation.

Ores were described by Ernesto Rios, owner of the mine, as bornite, chalcopyrite, and chalcocite, with minor galium and germanium values. Rios said that he has leased the mine to Alfredo Sanchez Flores, Mexican industrialist. General Superintendent at the mine is Roberto Belmontes. Arturo Magnani is mine superintendent. Some 90 men are reported to be employed.

Plant of Gulf Sulphur Corp., known in Mexico as Compañía de Azufre Veracruz, is nearing completion and is expected to begin operation late in August. Initially Gulf plans to steam four wells.

Presently Gulf's Frasch-process plant has two boilers with a capacity of 1.2-million gallons per day of superheated water. A third boiler, which will boost capacity to 1.8-million gpd, is expected to be installed no later than October of this year.

11-million tons of sulfur have been proven in 75 acres of the 7,414-acre concession at Salinas on the Isthmus of Tehuantepec's Coachapan River. In addition, 3.5-million more tons are probable in acreage contiguous to that already proven.

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IN AUSTRALIA

Australian Uranium Corp. N.L. is now ready for regular production at its Adelaide River mine. No. 5 shaft is now down 218 ft and a west-southwest crosscut at 200 ft has cut the lode at 40 ft from the shaft. No. 8 shaft will be sunk to develop pitchblende ore disclosed by diamond drilling.

Silver Valley Uranium Mine N.L. reports that an adit, put in 122 ft, revealed a lode up to 3 ft wide, which gave 11.3% lead, 9% zinc and 0.35% copper. Results were in accordance with the geophysical surveys.

Surface testing of outcrops on the South Alligator field of Uranium Mines N.L. & Northern Uranium Development N.L. has proved more than 10,000 sq ft or 750 tons a vertical foot of ore assaying better than 0.5% uranium oxide. A large tonnage of lower-grade material was also indicated in other outcrops. Scinto leases are disclosing ore of good grade. El Sharana lease has disclosed very good uranium oxide values.

Northwest Tantalum N.L. is ceasing operations and selling its assets.

Alluvial tantalite-columbite areas of Northern Territory Prospecting & Development Co. Ltd. are returning satisfactory profits. The areas on the Pilbara field in Western Australia are in full production. A special magnetic separator has overcome the previous unsatisfactory separation of tantalite-columbite from other minerals.

Widely differing reports came from gold producers. Harrietville (Tronoh) Ltd. has sold its electrically driven dredge because there was insufficient gold in its leases. Northern Mines Development N.L. has abandoned its options over the Granites and Wheal Doria mines, and Spring Hill Gold N.L. has suspended mining operations because development of the south end of the main lode failed to come up to expectations. Company will still diamond drill at Princess Louise mine and will examine copper and gold bearing areas at Oreaucu.

On the other hand, some gold companies are doing very well indeed. Australian Development N.L. of Tennant Greek has paid dividends totalling £A2-million in some five and a half years. Central Norseman Gold Corporation has struck some rich ore in two drill holes in the North Macaroa Crown reef.

One hole intersected a lode of 40 in. assaying 22.8 dwt while the second, about 200 ft away, struck ore 35 in. thick which went 5 oz 14.3 dwt. Lodes were cut at a depth of about 900 ft and are believed to be in the upper zone horizon. Mararoa ore now being developed from the No. 10 level of the Regent shaft occurs at this horizon. The reef is about 1,400 ft in the footwall of the Mararoa reef.

International Nickel Co. is joining Australian interests to explore and develop the nickel deposit at Mt. Davies in South Australia. A number of other over-

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After forging, AFCO grinding media receive carefully controlled heat treatment to produce maximum hardness and penetration consistent with toughness.

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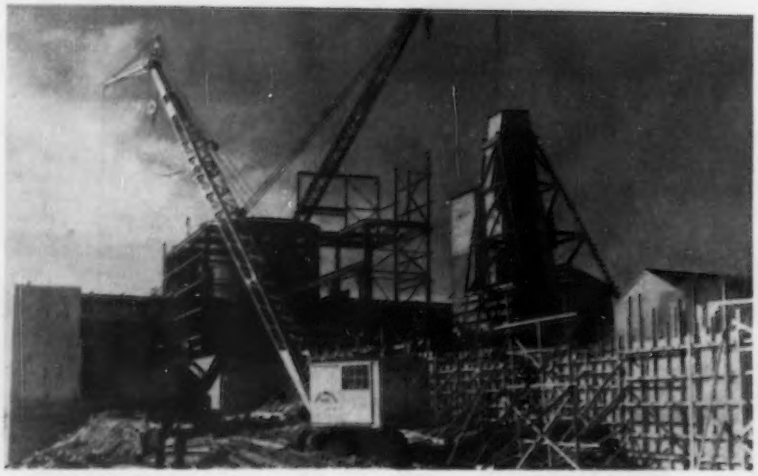

PRONTO URANIUM MINES reports everything on schedule in its mill building program, and the company appears to be sure of becoming the first producer in the Blind River camp (see *E&MJ*, June 1955). Mill's starting rate, calendared for September, will be 1,250 tpd, with an increase to 1,500 tons slated for early 1956. Underground work is going ahead smoothly and development on two levels at 111 and 206 ft suggests that ore dimensions and grade will be somewhat better than were indicated in original drilling.

Australia *(Continued)*

seas metal companies are associated with the venture. It is emphasized that no commercial orebodies had yet been established but the potential, as disclosed in preliminary surveys, was sufficient to warrant full-scale exploration.

Prospecting has started in Western Australia for lithium. Area selected is at Pilgangoora, about 60 miles southeast of Port Hedland. In Western Australia lithium is usually found in the form of spodumene and lepidolite.

NEW CALEDONIA

French organization "Le Nickel" expects to expand production "substantially" at its properties if French government approves. Increase in output will be from current level of 8,400 tons to 18,000 metric tons per year.

With the building of a dam on the River Yate, Le Nickel expects to install new electric reduction furnaces to produce 10,000 tons high quality ferro-nickel. Officials emphasize that expansion is entirely dependent upon construction of the new dam and added hydro-electric power.

IN EUROPE

YUGOSLAVIA

While actual production figures for 1954 have not been announced the government has announced production increases that will allow for the following capacity (metric tons) in 1955: coal, 800,000; coke, 225,000; oil, 330,000; pig iron, 227,000; crude steel, 380,000; zinc rolled goods, 12,000; aluminum rolled goods, 16,000; iron and steel rolled goods, 243,000; cement, 1,800,000; concrete iron, 70,000; rail, 50,000; and cast pipe, 23,000.

Further plans include raising copper production at Bor to 25,000 metric tons. Superphosphate production is to reach 575,000 tons. Production rate of 10,000 tpd has been scheduled for Majdanpeck iron ore deposit.

ENGLAND

New Imperial Chemical Industries plant will begin producing titanium this summer, it is reported. Plant will handle up to 1,500 tons of raw titanium annually.

Society of British Aircraft Constructors says the plant will be ready for full-scale operation in July.

FRANCE

Prof. Francis Perrin, French High Commissioner for Atomic Energy, told the Academy of Science in Paris that "our country has reached the stage of producing uranium on an industrial scale."

Prof. Perrin disclosed earlier that France will have two electric power stations based on atomic energy in operation within two years. Two piles, G-1 and G-2, have been developed to produce plutonium. G-1, which required an initial charge of 100 metric tons of uranium, will reach full power by July 1956. It will provide for a 5,000 kw power station and produce 12 to 15 kg per year.

G-2 is expected to begin operation in early 1957. Approximately the same

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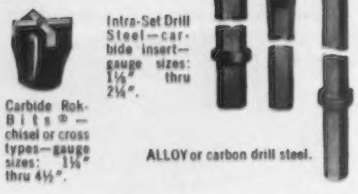
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France *(Continued)*

size as G-1, it is expected to be much more efficient, producing 50 kg of plutonium.

One uranium reduction plant is operating on a chemical process in eastern France, Prof. Perrin said, and a second is under construction at Vendee, site of four uranium discoveries. Vendee deposits are reported low-grade.

Other major sources of ore are at Lachaux, Puy-de-Dome, where early finds are nearly exhausted; Grury, Saone-et-Loire, where one small mine produces low-grade; and in Limousin, where pitchblende was discovered in 1948. Other regions "contain numerous evidences."

For its long-range program, France looks to "substantial" deposits of thorium in Madagascar, according to Prof. Perrin. Discoveries were made in the southeast part of the island in 1953 and the Commission reports "reconnaissance . . . shows . . . that we have probably found one of the richest sources of thorium in the world."

FINLAND

With iron ore running 0.5% vanadium, a process has been developed, at Otanmaki mine, for recovery of the metal as the pentoxide. Iron ore from the mine is crushed, ground, roasted to magnetize and dry and concentrated on magnetic separators. Magnetic concentrate is ball-milled with a sodium salt. Salted concentrate is pelletized and roasted to convert the vanadium to sodium vanadate.

Merenmies

Vanadate is leached out in hot water and the pellets, running 67% Fe, go on to the blast furnaces. Martti Merenmies, chief metallurgist, states that leaching is countercurrent using steam heated hot water and steam heated wooden tanks.

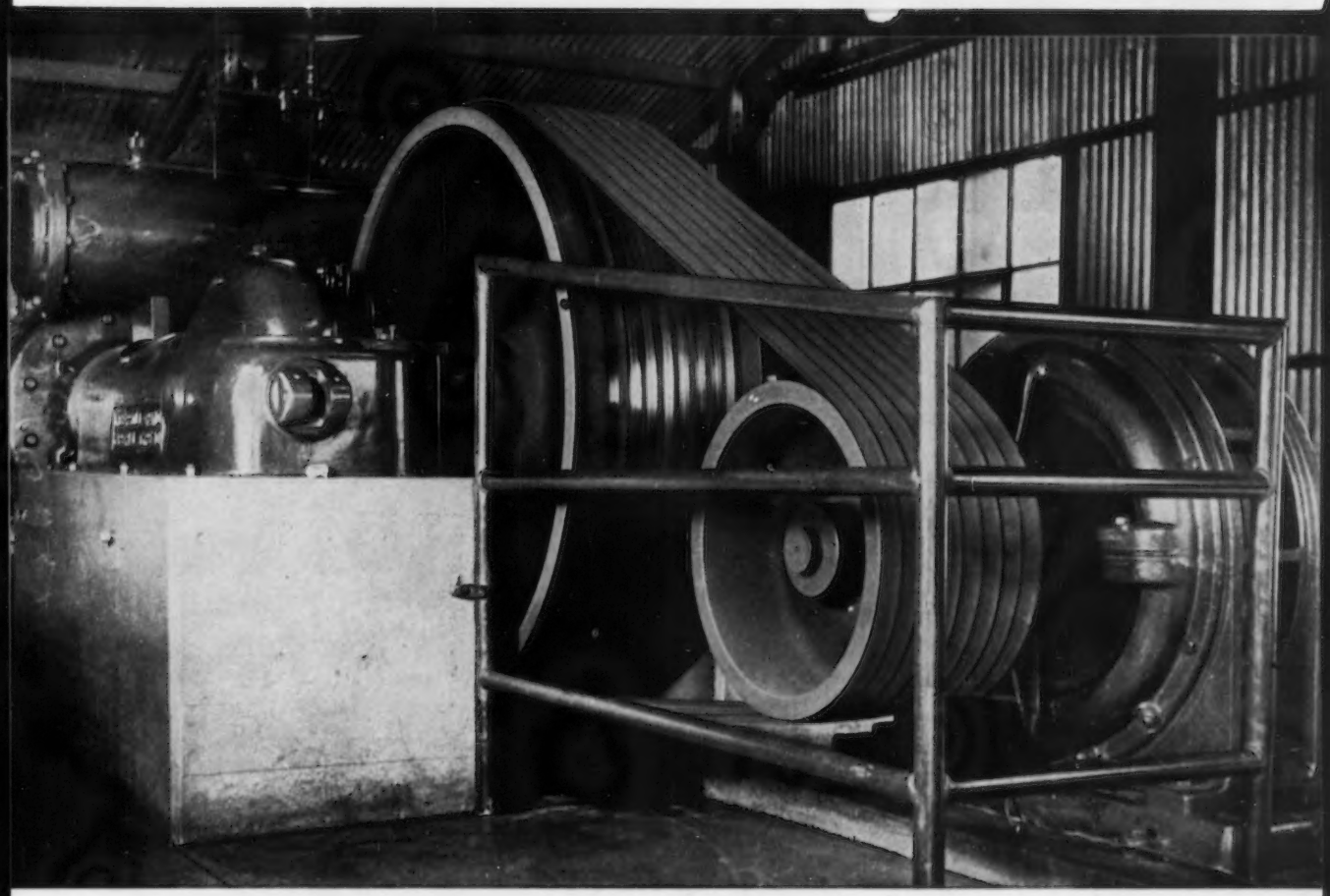
Pregnant solution containing 16-20 g/l vanadium is treated with sulphuric acid to throw down vanadic acid. Acid is press filtered and further purified. Smelting produces material 90% pure pentoxide.

Pilot model was a 50 lb a day unit. Plant, as designed by Professor Kauko Jarvinen, will produce 500 metric tons pentoxide and 70,000 metric tons pellets per year. Construction started this spring with full operations expected by mid 1956.

SCOTLAND

Resumption of lead mining in Scotland is being undertaken by Siamese Tin at the Glencrieff mine. $420,000 has been spent in the last two years to reopen the mine, last worked in 1936. Dewatering has opened the mine to the 940 level.

Electric locomotives will be used for



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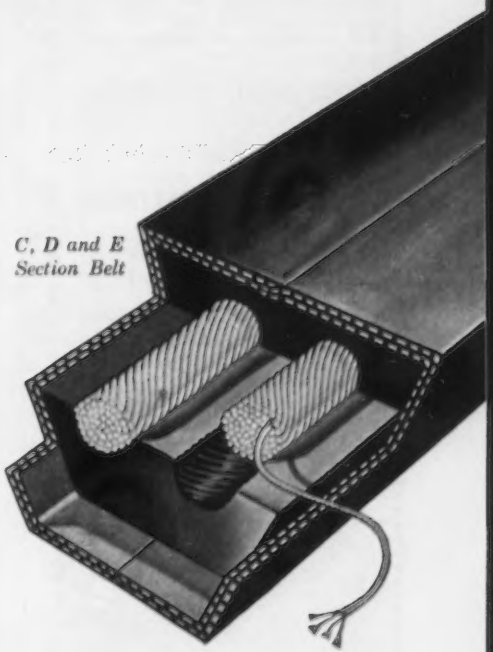

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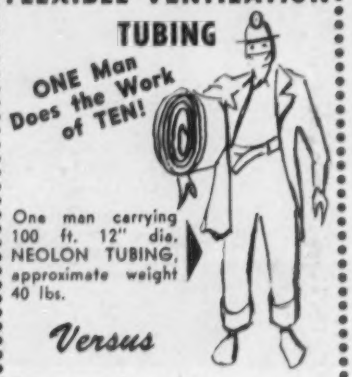

One man carrying 100 ft. 12" dia. NEOLON TUBING, approximate weight 40 lbs.

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Ten men, each carrying a 10 ft. length of 12" dia. metallic pipe (total 100 ft.) weighing approximately 1070 lbs.

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DIESEL SHOVELS and trucks move gypsum rock from National Gypsum's open pit at Halifax, Nova Scotia. Area, first drilled in July 1951, now has reserves of some 200-million tons. Trucks haul to primary crusher, which in turn supplies secondary, rock then goes to ships at Wright's Cove. 10,000-ton ships now carry the rock to National's plants. Two new plants are now being built, at Philadelphia and New Orleans.

Scotland *(Continued)*

underground haulage. 200-ton ore bin is planned for underground storage. Concentrator will be erected at the mine. Concentrate will be sent to smelter by truck.

Sufficient ore has been blocked out for the first five years and it is hoped that present explorations will provide further reserves. Some gold and lead have been taken out of this area since the 13th century. Veins tend to pinch out and disappear, making mining difficult.

In 1951 Siamese Tin joined with Rio Tinto Co. and Bangrin Tin Dredging Co. in this project. Siamese Tin now controls the entire operation. Further expenditures for mine and mill have been authorized by stockholders.

IN THE PHILIPPINES

Palawan Quicksilver Mines, first producer of cinnabar in P. I., reports plant construction has progressed on schedule and actual production will commence in July. Developed ore reserves total 135,000 tons, averaging about 8 lb mercury per ton (0.4%). George H. Newman, chief geologist of Marsman & Co., will direct development.

Philippine Bureau of Mines has declared that government-sponsored tests on Philippine nickel-bearing ores by electric furnace smelting have shown that a high-grade, low carbon-ferro nickel alloy can be recovered. Tests indicate that 35 lb of nickel as ferro nickel, can be obtained from each ton of ore smelted.

Atlas Consolidated Mining & Development Co. has contracted with Mitsubishi for the sale of iron ore from the Mati deposit in Davao. Contracts call for the shipment of at least 180,000 tons annually over a five-year period. Atlas will receive an advance payment of $500,000 from Mitsubishi for mine development, to be repaid within two years after shipments begin. First shipments of iron ore are expected by the end of the year. Contract is reported to call for a price of 17.5 pesos per ton of 58% iron with a premium of 60 centavos per unit for ore containing more than this grade. Colonel Charles M. Smith, manager of the mining department of A. Soriano y Cia, who control the property, has been in the United States interviewing technical personnel required for a large expansion program.

Luzon Stevedoring Co. has discovered additional mineral occurrences at San Jose, Antique, where it is working the Bongbongan copper and pyrites mines.

Shipments of copper concentrates to Japan from the Toledo Copper mine in May totalled 5,100 metric tons, containing 2,127,767 lb copper and 662 oz gold, valued at $654,000 after smelting and refining costs.

Dredging operations on the Coco Grove property of Marsman & Co. reportedly continue disappointing. In 1954, 1,956,500 cu yd were dredged with an average recovered value of 16c per yard. Gold recovery was not up to estimates from drill hole values because of erratic distribution in the gravel and the need of dredging a considerable yardage of low values to get flotation room. Costs were a reported 22c per yard, hence results were unprofitable.

IN AFRICA

Due to depletion of available payable ore and a level of working costs which is rendering operations unprofitable, two of

17,435,250 yards

Only 4 Page Automatic Buckets needed to excavate this enormous yardage of slate, blasted rock, and earth overburden. The Peterson Coal Company, Deerfield, Ohio, moved this material since 1942 with a Page Model 618 Walking Dragline and 5 cu. yd. buckets. The two buckets shown in the photo, and one other, are worn beyond economical repair but the Model 618 and the bucket on it are still in good condition.

"That's what we call good service," says Mr. Clyde Peterson, "so when we needed more coal than the 618 could uncover, we bought the Model 721 Page Walker shown in the picture. With a 7 cu. yd. bucket and 125 foot boom it's just what we wanted. Fast, economical, and easy to operate; and the new Page horizontal V-6 Diesel engine has plenty of power for even the heaviest load."

Page Automatic Buckets are noted for their digging ability. Write for bulletin GPB454 for details.

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Trial mining operations were expected to start at Hartebeesfontein G.M. in the Klerksdorp area during spring and official production during July. Work started on the collar of No. 1 shaft on Jan. 1, 1953 and on No. 2 shaft on Feb. 23. Until September, work was handicapped by a shortage of electric power, but during this period the two concrete headgears were erected and shafts sunk to the maximum possible depth using light equipment. Full-scale sinking started on Sept 1. at No. 1 shaft and at No. 2 on Nov. 14. On July 31, 1954, No. 1 shaft reached final depth of 3,041 ft. Seven stations were cut. On August 15 the final depth of 3,297 ft was reached in No. 2 shaft and No. 1 shaft development was started. During the first week a start was made with the erection of the reduction plant (above). On Dec. 31, a total of 15,793 ft of development was recorded for the preceding three months. Main haulage between the two shafts was holed through in mid-March, with a grand total of 36,800 ft of development.

Africa *(Continued)*

the older gold mines of the Witwatersrand will close down. Modderfontein B Gold Mines were formed in 1908 with milling capacity of 68,000 tons a month. Welgedacht Exploration has operated off and on since 1899 and mills 34,000 tons a month.

Milling capacity of Stilfontein G.M.—one of the new Klerksdorp mines—will increase from 90,000 to 150,000 tons a month. The Margaret shaft is to be deepened to open up the lower levels of the mine which will be served by a series of sub-inclines.

The scheme will be financed by working profits. Profits from uranium recovery are expected to increase appreciably.

Discussions are taking place between Anglo American and Anglo-Transvaal Consolidated to start up another major gold mine in the Klerksdorp district in the Western Transvaal—the fifth to come into being in the last few years. Drilling has revealed good values; some in excess of 1,000 in.-dwts at a depth of over 6,000 ft. Uranium and pyrite are understood to run at high levels. New mine will be under the technical control of the Anglo-Transvaal group, which is already operating new mines in the Free State and one in the Klerksdorp district. The area of the new mine will be about 5,000 claims, and adjoins the Stilfontein and Hartebeestfontein mines on the east and Vaal Reefs and Western Reefs on the south.

A new Orange Free State gold mining company has been formed—Free States Saaiplaas Gold Mining Co.—with an authorized capital of $18.1-million.

Company is to exploit 4,920 claims lying north of the existing Harmony mine. Drilling has yielded high gold values, some of them running in excess of 1,000 in.-dwts. Although there is no official news, it is generally accepted that this property will become a major uranium producer, in view of this work being undertaken by all the adjoining properties.

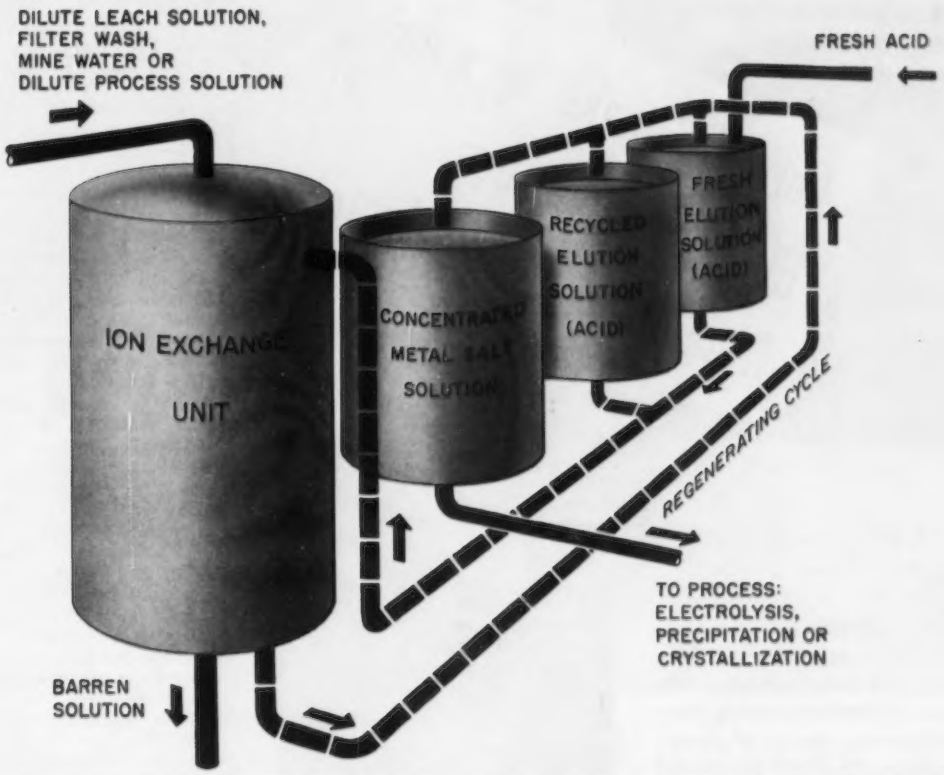
Exports of "prescribed materials" (uranium and monazite) from South Africa for the first four months of this year amounted to over $20-million compared with $10-million for the comparable period of 1954. According to the latest estimates annual production of uranium should be running about $110-million a year by 1957.

Production stage should be reached by the end of the year by South Africa's State-controlled Phosphate Development Corp. Initial rate will be 1,000 tpd rock phosphates from the large quarries in the Eastern Transvaal and 70,000 tons of concentrates produced a year. This will supply about one-sixth of the country's rock phosphate requirements.

A laboratory to conduct research work at industrial level for the mines of the Rhodesian Selection Trust group—Roan Antelope, Mufulira, and Chibuluma—has been set up in Northern Rhodesia. At present it is tackling metallurgical problems of the Chibuluma cobalt deposit which is reported to be of a very high grade.

An intensive search for minerals of all descriptions including radioactive min-

METAL CONCENTRATION BY ION EXCHANGE



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The simplified flow diagram shown above illustrates the main principles of ion exchange in concentrating metals from leach liquors, filter washes, other dilute process solutions or mine waters:

As the feed solution or mine water passes through the ion exchange unit, the metal values are concentrated on the ion exchange resin, generally in preference to other ions present, leaving the solution or mine water metal-free. When the metal-attracting property of the resin is exhausted, an appropriate elution solution, for example an acid, is passed through the resin to pick up the metal. In most cases, the elution solution also acts as regenerant to restore the metal-attracting capacity of the resin . . . as shown on the diagram. Recycling the elution solution provides high concentrations . . . often several thousand times as concentrated as the original feed solution.

Ion Exchange methods apply to these metals:

Base Metals	Minor Metals	Precious Metals
Copper	Cobalt	Gold
Zinc	Tungsten	Silver
Lead	Molybdenum	Platinum
Tin	Vanadium	**Rare Earths**
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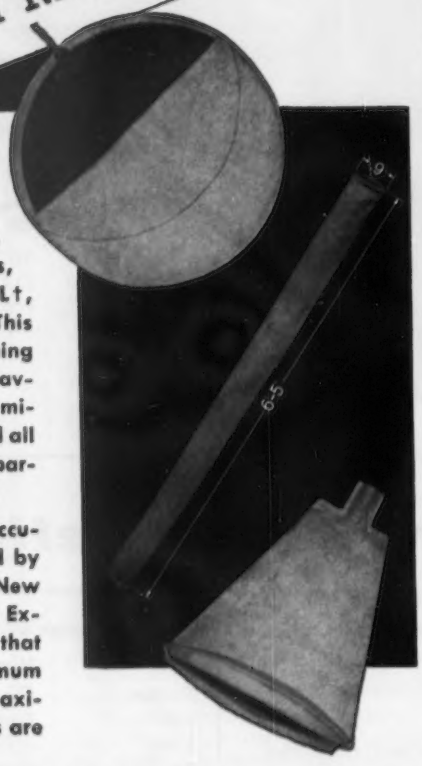

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Africa *(Continued)*

erals is to be started in three large but little-prospected areas covering 104,000 sq miles of Northern Rhodesia.

Sir Ellis Robins, resident director of the British South Africa Co. which pioneered and originally administered the two Rhodesias, announced today that his company had registered a new company known as Chartered Exploration Ltd.

New system of disposing waste rock has been instituted by Richard Sutcliffe S.A. of Johannesburg.

An inclined conveyor takes the waste to a short radial spreader, capable of discharging the material at a radius of 20 to 28 ft by a screw extension of the boom, thus building up its own ramp.

After the discharge of the material at a radius of 28 ft, the inclined conveyor is stopped and the spreader and portable jib drawn forward on rails and a standard 8 ft framework section installed between the jib and the drive head of the inclined conveyor. When a predetermined height has been reached the inclined conveyor jib can be arranged to discharge on to one or two wing conveyors which can be extended horizontally to each side. Capacity of a 135-ft high dump on level ground is 360,000 tons and with two wing conveyors 400 ft long this is raised to 500,000 tons and each advance will be made after dumping an additional 150,000 tons.

Application has been made to the Government for a mining lease over an area in the Orange Free State, lying between the Harmony and President Steyn mines by the New Consolidated Gold Fields group, which operates mines in the Transvaal, including the extremely rich West Driefontein property. Drilling in the new area has revealed high values. This will bring the number of mines in the Free State to 14.

A syndicate of British businessmen sponsored a provisional survey of a $50-million railway line across Northern Bechuanaland and South West Africa to provide a direct outlet for the Rhodesias to the West Coast of Africa.

The chairman of the syndicate stresses the need to develop the mineral resources of the area which the line is proposed to go through and the strategic importance of a west coast port to the Western Powers—particularly an outlet for Rhodesia's chrome supplies. In addition, the line would enable Wankie coal to be exported after the development plant at the colliery is completed.

IN ASIA

JAPAN

Mitsui Mining and Smelting Co. will send a 10-man team to Negros Island to conduct a comprehensive survey of the Sipalay copper mines. Mitsui Mining and Smelting and another Japanese firm, Nanyo Bussan Co., joined with the Eliz-

5-second rescue from motor burn-outs

with HYDRO-SHEAVE® Drive

Every time the temperature dropped, Stoneridge Limestone Company had a severe starting problem. Bringing their vibrating screens up to full speed under load—*with mechanical drive*—ate up 15 minutes before the cold bearings and belts loosened up. Production time was lost. But even worse, the unavoidable result was motor overheating from severe and prolonged starting loads . . . a condition pointing straight to motor burn-outs in a matter of time.

To solve the problem, Stoneridge called in their Authorized Twin Disc Hydraulic Dealer—Rockford Tool & Transmission Company.

The solution was quick and easy: Twin Disc HYDRO-SHEAVE Drives, slipped on the output shaft of motors powering the vibrating screens.

Results were immediate. The silken "slip" of *fluid* within the HYDRO-SHEAVES—*eliminating* mechanical connection—picked up the heavy starting load smoothly, automatically . . . permitting the motors to accelerate to normal rpm *within 5 seconds*, preventing overheating and inevitable burn-outs—and increasing production by eliminating the 15-minute warm-up period.

In addition, the cushioning effect of the HYDRO-SHEAVE Drives *absorbs* the shock loads, overloads, and vibrations inherent with the operation.

Whether you are driving equipment with motors or engines, if your installations are between ¾ and 850 hp you can *improve performance*—and obtain *positive protection*—with Twin Disc Fluid Drives. Write *today* to Twin Disc, Dept. DS, Racine for *new* Bulletin 144-D, giving *complete* description of the 10 different models of Twin Disc Fluid Drives—illustrating their wide variety of input, output combinations plus their ease of installation.

Twin Disc 10.6 HYDRO-SHEAVE Drives boost performance, protect motors and driven parts on 4′ x 10′ triple-deck vibrating screen (left) and 4′ x 12′ double-deck vibrating screen (right) at Stoneridge Limestone Company, Rochelle, Ill. HYDRO-SHEAVE is easily installed on either engines or motors. Capacities from ¾ to 50 hp.

TWIN DISC

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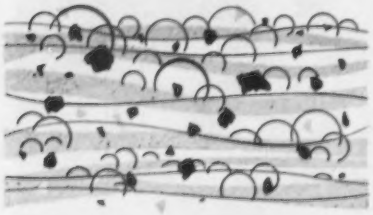

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Japan *(Continued)*

alde Co. of the Philippines in January 1954 to incorporate the Sipalay Copper Mining Co.

Three Japanese companies are producing germanium experimentally. Mitsubishi Metal Mining Co. and the Mitsui Mining and Smelting Co. are extracting the metal from zinc sludge and the Tokyo Gas Co. from coal gas. A total of about 70 kg germanium oxide are produced annually on a pilot basis by the three firms.

Newspaper Asahi reported discovery of Japan's biggest uranium deposit in northernmost Honshu. The discovery of a deposit of at least 7000 tons was credited to Dr. Makoto Shima of the Institute for Scientific Survey and his party.

RUSSIA

Russia claims to have increased lead production 100%, aluminum 140% and zinc 71% from 1951 through 1954 (the first four years of the Fifth Five-Year Plan). No mention was made of copper production gains during the period.

Official government newspaper *Izvestia* says that plans call for further 11.7% increases for both copper and lead output, 16.5% for zinc, and 9.8% for aluminum in 1955.

(A recent U. S. Government survey of Soviet bloc economies estimated that Russia produced 334,000 metric tons of copper, 148,000 metric tons of zinc, and 225,000 metric tons of aluminum in 1952. Lead (mine) output in the early postwar years was estimated at a maximum of 144,000 metric tons. Russia has issued no recent tonnage figures covering production of these metals.)

Official Russian government newspaper Izvestia charges that the USSR Ministry of the Chemical Industry has, "for a number of years," paid insufficient attention to production of flotation reagents. It says that the increasing amount of ore processed by the flotation method in nonferrous metallurgy and other branches of the national economy "urgently requires radical improvement in organizing output of the necessary variety of high-quality flotation reagents."

Government spokesmen have also chided mining equipment manufacturers for failing to speed production.

USSR Gold Output Set at $125-Million

Table I. Free World Gold Production

(In millons of U. S. dollars)

	1946	1947	1948	1949	1950	1951	1952	1953	1954 (est)
Union of South Africa	$417.5	392.0	405.5	409.7	408.2	403.1	413.7	417.9	463.2
Canada	99.6	107.5	123.5	144.2	155.4	153.7	156.5	142.4	152.8
USA	51.2	75.8	70.9	67.3	80.1	66.3	67.4	69.0	66.0
All others	84.9	181.2	205.1	218.8	220.8	216.9	229.9	228.2	208.0
	$753.2	756.5	805.0	840.0	864.5	840.0	867.5	857.5	890.0

Table II. Private Gold Hoardings

(In millions of U. S. dollars)

end October	1951	1952	1953	1954
France	$4,100	4,000	4,000	3,800
All other Europe	2,000	2,100	2,200	2,000
Asia	1,800	2,000	2,400	2,500
Africa	1,800	1,900	1,800	1,400
Western Hemisphere	900	1,200	1,400	1,400
Miscellaneous	600	700	700	600
Total	$11,200	11,900	12,500	11,700

SOVIET PRODUCTION of gold on an annual rate has been estimated by Franz Pick, publisher of the 1955 Pick's Currency yearbook* to average about 3½-million oz, with a value of $125-Million (U.S. Price).

In the chapter on gold in the forthcoming issue of the annual publication, Pick discusses the estimates of Russian production by various international factors and then makes his own "reasonable guess." Included in the chapter on gold are figures for Free World production 1946-54, (see Table I); and computations of gold hoardings, with a breakdown of variations in private caches since 1951. (See Table II.)

Also included in the yearbook chapter is a discussion of the private gold trade, history of private gold stocks, principal trading centers of the world, trade volume and price movements.

Gold hoardings in official international agencies and monetary administrations at the end of 1954 are set by Pick as follows (in millions of U.S. dollars):

United States	$21,793
United Kingdom	2,600
Switzerland	1,513
Canada	1,073
Netherlands	796
Belgium	778
International agencies	2,090
Others	5,757
Total	$36,400

Official gold holdings are combined by the author with estimated French government holdings (600-millions plus); estimated Soviet gold stocks (2,000 plus); and estimated satellite gold stocks (100 plus) to give a total of $39.1-billion. Adding $11.7-billion for private hoards around the world, Pick arrives at a figure of $50.8-billion for the total gold hoard.

* 400 pp., $35. Pick's World Currency Report, publishers. 75 West St., New York 6. N. Y.

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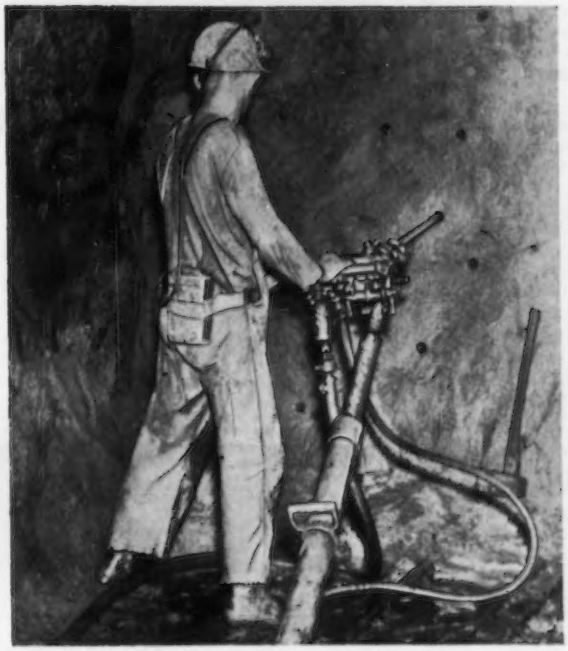
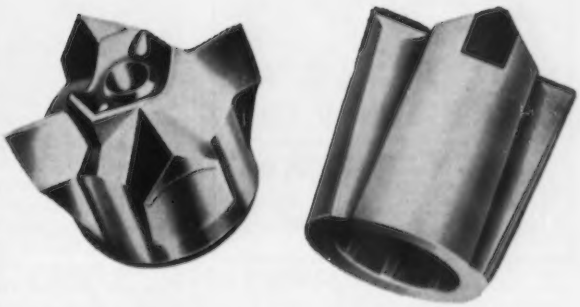


the bit for fast feed leg drilling



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INDIA

Some mining men believe there might be greater Russian participation in mineral exploration in Indian fields. New Russian interest, they say, might come as a result of Nehru's current visit to the USSR. In dispatches received from Nehru, it was hinted that there would be greater economic cooperation between the two countries. This coincides with an Indian Government announcement of an immediate $40-million exploration program. Oil exploration, industry sources say, for the present will remain in U.S. and British hands.

Titanium dioxide industry has been granted a further tariff protection until December 31, 1957, the Commerce and Industry Ministry has announced. Rates of protective duty on the pigment have been revised to 44% ad valorem (standard) and 34% (preferential) as of July 2. Tariff Commission has recommended, inter alia, that Travancore Titanium Products Ltd. should be permitted—during the period of protection—to restrict its production to the anatase type, leaving India's requirements of rutile to be covered by imports.

Hewitt-Robins, Inc., has been awarded contracts totaling more than $1,250,000 for conveyor belting and machinery to be installed by the Indian Iron and Steel Company, Burnpur, India, as part of the country's industrial expansion program. One conveyor system will bring iron ore down from the side of a 6500-ft mountain at Gua, where it will be put on railroad cars and shipped 180 miles to the steel plant. At the steel plant a second conveyor system will transfer the ore from the railroad cars to blast furnace bins or nearby storage piles.

Motor-generators on the mountain conveyor system will serve as a brake to restrain the downhill speed of the conveyors. Energy produced by the conveyors as they "coast" down the slope will be converted into electrical power in somewhat the same manner as the water of Niagara Falls is harnessed to generate power. This "free" electricity will drive machinery for processing ore at the mine.

Joint authority was to start work on Jan. 1 to implement the Government of India's $115-million lignite project scheme in Neiveli, South Arcot district (Madras State).

The authority, consisting of representatives of the Indian and Madras State Governments, is assisted by a team of British experts, who have done all the groundwork.

The scheme provides for: production of 3.25-million tons of lignite annually; erection of a power plant (200,000 kws), a 200,000-ton ammonium sulphate factory, and briqueting of 700,000 tons per year (for boilers, etc.) and preparation of 350,000 tons of carbonized briquets.

Plan, to be taken up and completed during the first three years of the second Five-Year Plan, i.e., by 1959, will be a joint venture of the New Delhi and Madras governments but the property of Madras. Almost all the foreign technical assistance, now secured, is British.

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A 22½-ton Moto-Crane, model MC-424 (top photo), is shown handling pipe on plant erection work in St. Louis. For this kind of surface work, the travel speed and mobility of the Moto-Crane made it ideal for the many varied job needs.

By contrast, a Lorain Scoop Shovel works deep underground on another National Lead Co. mining operation. Low headroom was the problem—and a Lorain efficiently solved that problem, too. With its 1¼-yd. bucket, the Scoop Shovel crowds into the ore with a powerful horizontal action. It can revolve through 360°. Thus, from a single position, it can load out the hauling units, do a good "clean-up" job, while eliminating the costly, constant wearing travel required by some other methods.

Because the Lorain line of crawler and rubber-tire shovels and cranes is so complete, mines fit these versatile machines to all kinds of digging, material handling, maintenance and erection work. There are cranes on crawlers up to 61-ton capacity . . . shovel sizes on crawlers through 2½-cu. yd. Fast, mobile rubber-tire cranes are available in capacities up to 45 tons.

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A Lorain Scoop Shovel works deep underground, digging and loading lead ore into hauling units. The problems of low headroom and close digging quarters were solved by the Scoop Shovel.

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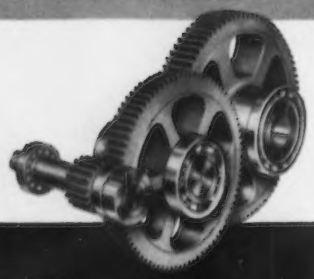

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India *(Continued)*

In a recent survey of minerals in India, the following figures were obtained: "at least 8,000 tons monazite is present in beach sands in Andhra State . . . it has also been found in Travancore-Cochin, on the Coromandel coast and on the Sabarmati River. Erection of uranium metal plants at Trombay and at Takshilla, Bihar, is progressing. Manganese, chromite and gypsum led in exports. Central Provinces Manganese Corp. is building a heavy-media plant in Madhya Pradesh.

IN THE NEAR EAST

EGYPT

A copper mine has been discovered at Rukaita, in Sinai Peninsula, according to Dr. Mahmoud Attiya, director general of the Mines and Quarries Department. Dr. Attiya said that copper veins extended between the Gulf of Suez and the Gulf of Aqaba, in the southern tip of the peninsula.

Mining research in that area has also revealed that the mine was exploited by the ancient Egyptians.

LEBANON

The Lebanese government granted Kazem Khalil, Pierre Khoury and Antoins Michel Sehnawi permission to establish one or more foundries in Lebanon for the production of industrial iron or cast iron. Productive capacity will be determined when final studies have been submitted to the Lebanese Ministry of Planning in the light of local needs and prospects of exploration. These quantities will also be determined by the prospects of extraction of the actual ores.

ISRAEL

Dr. Ernst D. Bergmann, chairman, Atomic Energy Commission for Israel, has reported two developments which could be significant in that nation's atomic energy future.

He told a radio audience that 2½ yr of research have developed: 1) a cheaper method of extracting uranium from radioactive phosphates which are found in abundance in the Negev; 2) a new process for enrichment of heavy water from ordinary water without use of expensive electric energy.

Both processes have been placed at the disposal of the French Atomic Energy Commission with which Israeli scientists have been working for 20 months.

Dr. Bermann expressed belief that Israel's phosphate extraction method could be applied to other low-grade ores

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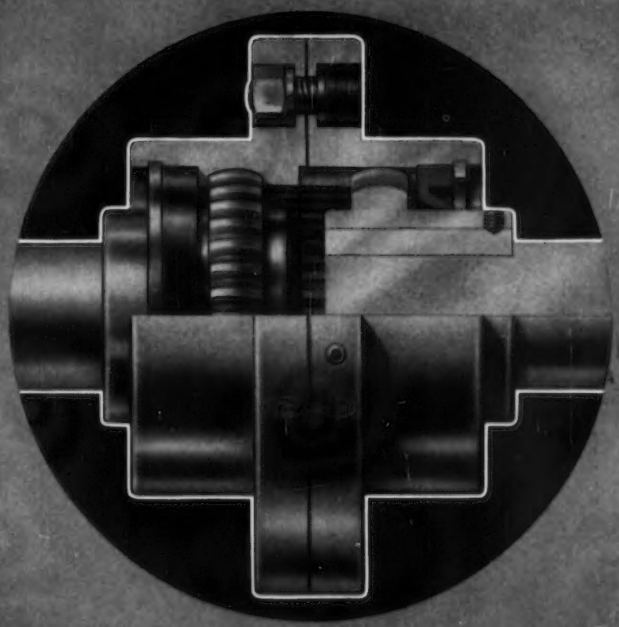

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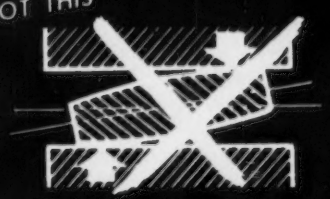

Standard gear type coupling—note excessive backlash and stress concentration when coupling is flexed.

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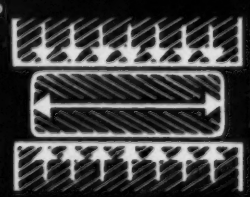

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CHUTE from storage bunker loads hand car. Weight is carefully observed.

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AUSTRIA'S ONLY antimony mine, located at Schlaining, Burgenland province, Russian Zone of Occupation, ships an average of 839 metric tons per month to Belgium for processing.

1954 figure represented a considerable drop from the 1952 (888 tons per month) and 1951 (1,012 tons) and showed great contrast with the all-time record, 1,214 tons per month, set in 1950.

During 1950 and 1951, the Schlaining operation received European Recovery Program funds for modernization of its agglomeration mill. Company plans for construction of an antimony processing mill in Austria were not realized, so concentrate is still shipped to Belgium; and to other European processors.

Annual imports of antimony in finished form approximate 100 metric tons, according to official sources.

Schlaining deposit contains an average 3.7% stibnite ore. Only one other such deposit is known in Austria, and is not being worked at the present time.

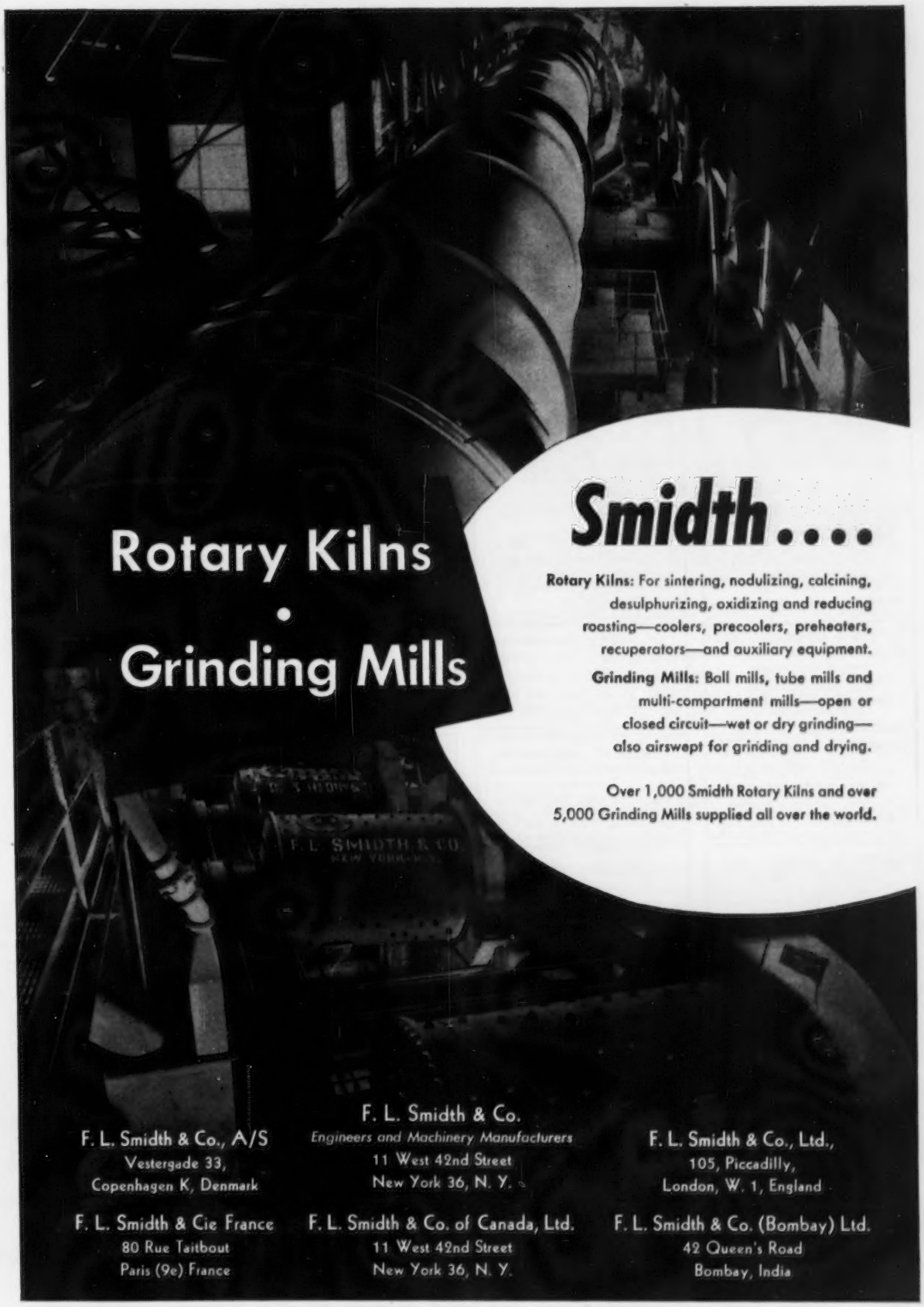
Ore is crushed and floated at the mine site, then dewatered on drum-type filters. Cake is scraped into sacks, carefully weighed, tagged and prepared for shipment.

Final result of the upgrading process is a 62.5% stibnite-content concentrate. Concentrate, 95% sulphurous antimony, is packed in 110-lb sacks. Current price for the Austrian product stands at approximately 7,500 Schillings ($288.46) per metric ton. Company figures show that for some 9- to 10,000 metric tons ore mined each year, Belgian mills produce 400 to 450 tons of antimony metal.

110-LB SACKS receive finished concentrate for shipment to mills in Belgium.

ORE COMES to flotation plant from storage bunker via trestle (atop plant left) and from mine via steep cable-run railway (right). Plus-9,000 tons are mined annually.

CONCENTRATE, 62.5% stibnite, is removed from drum filter after flotation.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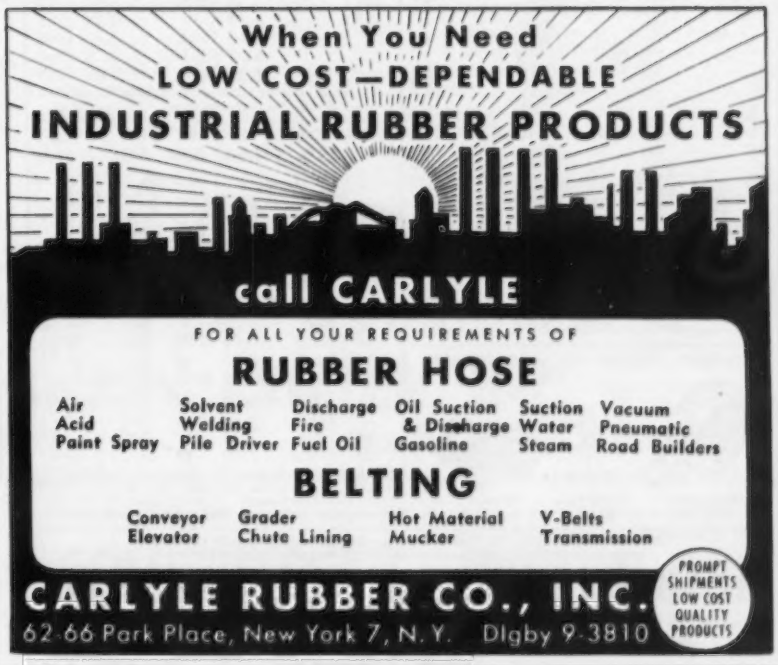

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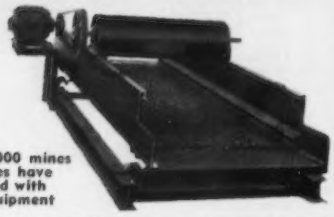

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16"	85'	3102	1558
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18"	45'	1839	1005
18"	60'	2384	1254
18"	85'	3209	1665
18"	100'	3704	1912
20"	25'	1265	713
20"	45'	1965	1060
20"	60'	2490	1320
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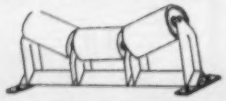

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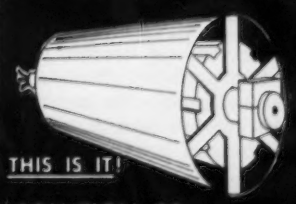

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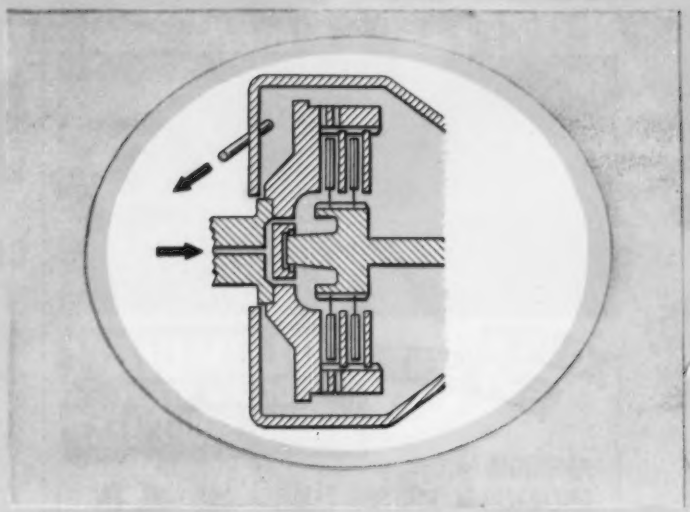
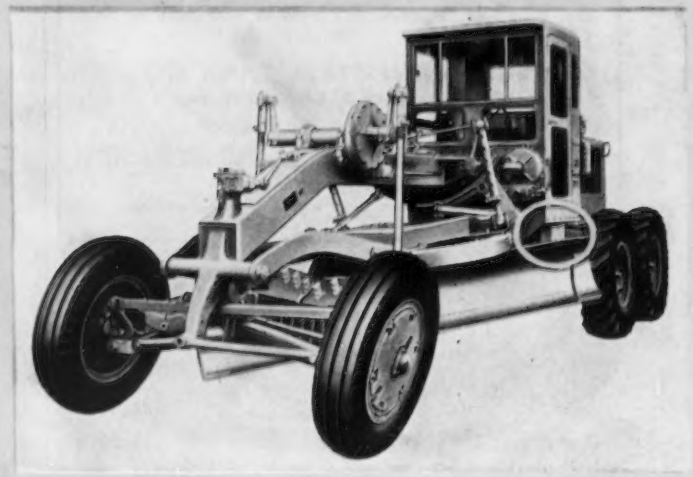
NEW OIL CLUTCH for the NO. 12 MOTOR GRADER



Arrows show path of oil through housing with clutch disengaged. Facings remain cool and bathed in oil, which is carried to outlet at top by flywheel ring gear. The two steel clutch discs and clutch brake are faced with pressure-processed cork, which gives an excellent coefficiency of friction and long wear.



The new oil clutch for the No. 12 Motor Grader gives you the same reliability and improved performance as the thoroughly job-proved oil clutch in Caterpillar track-type Tractors. Rugged and reliable, it uses oil from the engine lubrication system. Here are some of the things the new oil clutch for the CAT* No. 12 can mean to *you:*

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Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

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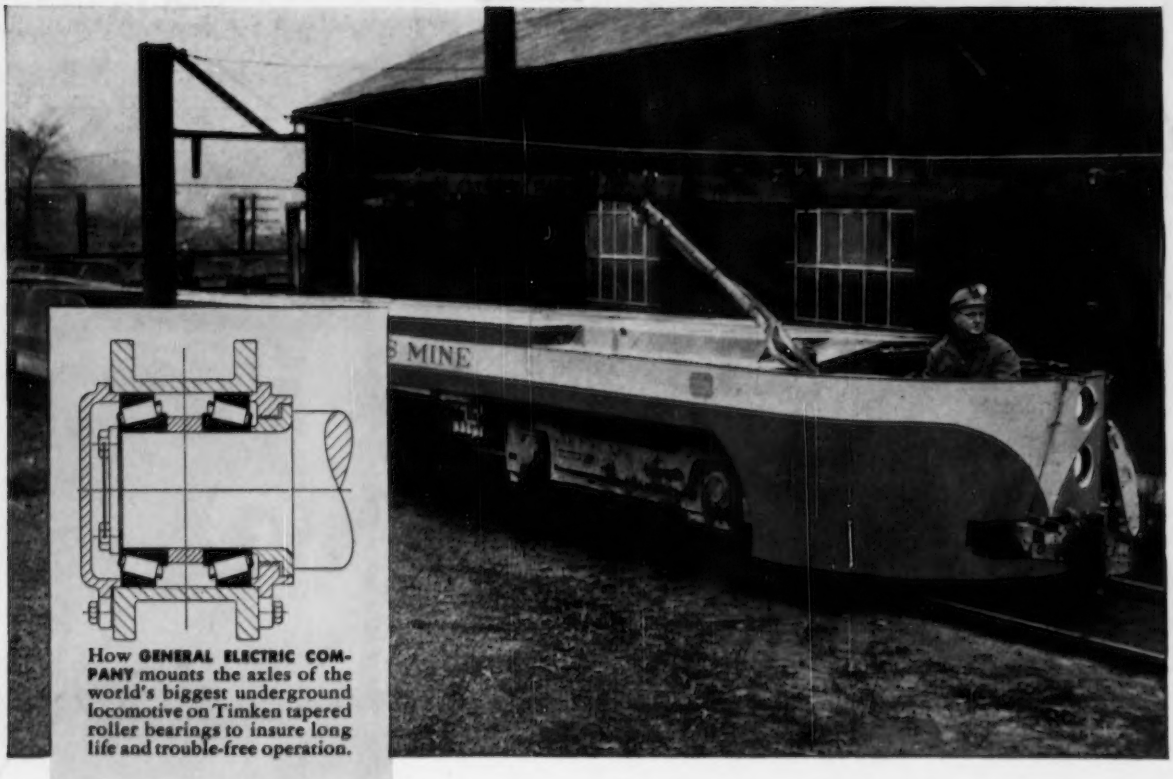

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World's biggest underground mine locomotive rolls on 16 TIMKEN® bearings

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